Malheur Invasive Plant Treatment Project – Final Fisheries Report and Biological Evaluation for the Final Environmental Impact Statement

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Introduction

Fish species of special conservation concern (e.g., federally listed, USFS sensitive, USFS management indicator species) within the aquatic environment analyzed in this report include the native bull trout, middle Columbia River steelhead, middle Columbia River Chinook salmon (including essential fish habitat), redband (rainbow) trout, and westslope cutthroat trout. In addition, one USFS sensitive aquatic macroinvertebrates is addressed. All aquatic species of special conservation concern (and their habitat) will be analyzed for both effects to individuals and effects to habitat.

During public scoping, concerns were raised about the use of herbicides near streams or other surface water that may result in herbicide concentrations in water that are harmful to fish (particularly ESA listed fish and native fish) and other aquatic organisms. Manual and mechanical treatments can also impact water quality, fish, and other aquatic species by disturbing riparian structure or increasing sedimentation. This report estimates effects to aquatic species and their habitat from herbicide and non-herbicide treatment methods.

Detailed analyses of federally listed fish species are provided in the project fisheries biological assessment (for preferred alternative only). This document serves as the project biological evaluation for USFS sensitive aquatic species.

PACFISH (2005) and INFISH (2005) are programmatic strategies to help maintain and restore aquatic habitats on the Malheur National Forest and other Forests east of the Cascade Mountains. Riparian Management Objectives (RMOs) are identified in these strategies and Forest projects are designed to contribute to meeting these objectives, or at least not block attainment of RMOs. Our progress toward maintaining and restoring good fish habitat is measured at the 3rd to 6th order streams scale within 6th field watersheds, based on measurable indicators of good fish habitat.

The indicators are pool frequency, water temperature, amount of large woody debris, lower bank angle of the creek, and width to depth ratio. These indicators are addressed through the matrix of pathways and indicators discussed for fish species.

Treatments authorized under this invasive plant treatment project could be implemented as part of aquatic habitat restoration activities on the Forest. The long term intent is to restore native plant communities to the extent possible. However, treatments near the aquatic environment have the potential for short-term adverse impacts. In general, these adverse impacts are very small in comparison to the beneficial impact of the restoration.

Table 1: Aquatic species of special conservation concern

Species	Status	Occurrence	Note
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Federally threatened, designated critical habitat, management indicator species	Documented occurrence	Middle Columbia River distinct population segment (DPS)
Bull trout (*Salvelinus confluentus*)	Federally threatened, designated critical habitat, management indicator species	Documented occurrence	John Day and Malheur species management units (SMUs)
Middle Columbia River Chinook salmon (*Oncorhynchus*	Essential fish habitat and USFS sensitive	Documented occurrence	Essential fish habitat (EFH)

tshawytscha)			
Redband trout (*Oncorhynchus mykiss gairdneri*)	USFS sensitive*, management indicator species	Documented occurrence	Widespread
Westslope cutthroat trout (*Oncorhynchus clarkia lewisi*)	USFS sensitive*, management indicator species	Documented occurrence	Present in John Day River and tributaries
Western ridged mussel (*Gonidea angulata*)	USFS sensitive*	Documented occurrence	Only known in Middle Fork John Day River

*From 2011 Region 6 list.

Regulatory Framework

The Executive Order 12962 of 1995 (aquatic systems and recreational fisheries) requires federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. The Order requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

The two principle laws relevant to fisheries management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Direction relative to fisheries is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36CFR219.19).

- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) if a proposed activity may affect the population or habitat of a listed species.

The Malheur National Forest Land and Resource Management Plan (LRMP) as amended (USDA 1990), provides direction to protect and manage resources. Of special interest are Forest LRMP amendment 29 and PACFISH/INFISH (1995). Recommendations regarding fisheries habitat would adhere to this regulatory framework.

Fish-bearing streams, are assigned 600-foot wide (total width) riparian habitat conservation areas (RHCAs), as defined within PACFISH/INFISH. RHCA widths along other streams in the Project Area vary depending on whether streamflow is perennial or intermittent. Treatment within RHCAs would be designed to follow PACFISH/INFISH goals and requirements. Specific to this project is PACFISH/INFISH standard RA-3: "Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of the Riparian Management Objectives [RMOs] and avoids adverse effects on inland native fish (INFISH)/ listed anadromous fish (PACFISH)."

Key Watersheds: The intent of designating Key Watersheds is to provide a pattern of protection across the landscape where habitat for fish species of special conservation concern would receive increased attention and treatment. Priority within these watersheds would be to protect, or restore habitat for listed stocks, stocks of special interest or concern, or salmonid assemblages of critical value for productivity or biodiversity. Criteria considered to designate Key Watersheds are:

1. Watersheds with stocks listed pursuant to the ESA, or stocks identified in the 1991 American Fisheries Society report as "at risk" or subsequent scientific stock status reviews; or

2. Watersheds that contain excellent habitat for mixed salmonid assemblages; or
3. Degraded watersheds with a high restoration potential

Threatened and endangered species are listed under the ESA; whereas, sensitive species are identified by the Forest Service Regional Forester. An endangered species is an animal or plant species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A sensitive species is an animal or plant species for which species viability is a concern either a) because of current or predicted downward trend in population numbers or density, or b) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Forest Plan Standard 62 (p. IV-32) gives direction to meet all legal and biological requirements for the conservation of threatened and endangered plants and animals.

Standard 62 states, "Assess all proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species."

When threatened or endangered species or habitats are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Forest Plan Standard 64 further states, "Meet all consultation requirements with the USFWS and state agencies." Effects to aquatic threatened, endangered, and sensitive species are analyzed in the Aquatic Biological Assessment/Evaluation located in the Project Record.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of Chinook salmon Essential Fish Habitat (EFH) descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH.

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities. Through the MIS concept, the total number of species found within the Forest is analyzed using a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand. Forest Plan Standard 61 (p. IV-32) lists species and gives direction to provide for habitat requirements of MIS species. Aquatic MIS on the Forest include: rainbow/redband trout, bull trout, cutthroat trout, and steelhead trout.

Overview of Issues/Elements of the Purpose and Need Addressed

Relevant Issue/Purpose and Need Indicators from Chapter 1

Issue Statement: Proposed herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching and/or run off) and adversely affect aquatic and riparian dependent organisms (specifically fish) and water quality.

Background: The proposed action will minimize potential for herbicide delivery to surface waters, wetlands and wells. Proposed herbicide use will not contaminate drinking water and water quality standards will be met. However, the risk that some chemicals may reach surface waters and adversely affect aquatic organisms cannot be eliminated. Treatment extent, rate and method of application and the properties of the chemicals proposed influence the degree of risk. There is specific concern about picloram use. The main focus of this issue is the potential for aquatic species of conservation concern.

- Type and extent of herbicide use within 100 feet of streams and other water bodies; riparian areas and road drainage networks near streams, drinking water intakes and wells.
- Plausible picloram exposure scenarios where drinking water might be contaminated (extent, nature of risk)
- Plausible picloram exposure scenarios where aquatic organisms might be harmed (extent, nature of risk)
- Qualitative assessment about whether or not, and how aquatic species of conservation concern might be affected by all types of proposed treatment

Other Topics Addressed

All aquatic species of special conservation concern (and their habitat) will be analyzed for both effects to individuals and effects to habitat, including the following: federally listed species, USFS sensitive species, and USFS management indicator species.

Affected Environment

Existing Condition

Aquatic Species

Steelhead

Steelhead (Middle Columbia DPS, MCR steelhead) was listed by NMFS as threatened under the federal ESA on March 25, 1999 (64 FR 15417). MCR steelhead are also a Malheur National Forest MIS. Critical habitat for MCR steelhead was designated on September 2, 2005 (70 FR 52630).

Life History (NatureServe 2013): Migrates between freshwater breeding and marine nonbreeding habitats. Steelhead typically spend two years in fresh water, migrate to marine waters, where they spend 2-3 years, then return to natal stream to spawn. Most middle Columbia River steelhead smolt at two years and spend 1-2 years in salt water prior to re-entering fresh water, where they remain up to a year before spawning. First-time spawners generally are 4-5 years old. Individuals are capable of spawning more than once before they die, though spawning more than twice is rare. Steelhead eggs incubate 1.5-4 months before hatching (varies with temperature). Juveniles spend 1-4 (generally 2) years in fresh water before migrating to the ocean as smolts.

Steelhead are capable of surviving in a wide range of temperature conditions. They do best where dissolved oxygen concentration is at least 7 ppm. In streams, deep low velocity pools are important wintering habitats. Freshwater habitat types utilized include: big and medium rivers, creeks, low to high gradient, pools, and riffles. Usually requires a gravel stream riffle for successful spawning. Eggs are laid in gravel in a depression made by the female. Salinity of 8 ppt is the upper limit for normal development of eggs and alevins.

John Day River status (ODFW 2009): The John Day River Major Population Group (MPG) covers Oregon's John Day River drainage. The MPG contains five extant populations (Lower Mainstem John Day, North Fork John Day, Middle Fork John Day, South Fork John Day and Upper Mainstem John Day). Steelhead in these populations are exclusively summer steelhead. The MPG is one of the few remaining summer steelhead groups in the Interior Columbia basin that has had no intentional influence from introduced hatchery steelhead and that has recently been classified as strong or healthy. Spawning is widely distributed across tributary and mainstem habitats.

1. The Lower Mainstem John Day River population includes tributaries to the John Day River downstream of the South Fork John Day River. This widespread population is the most differentiated ecologically from other populations, occupying the lower, drier, Columbia Plateau ecoregion.
2. The North Fork John Day River population occupies the highest elevation, wettest area in the John Day basin. Population boundaries include the main stem and tributaries of the North Fork John Day River. The population was defined based on habitat characteristics, basin topography, and demographic patterns.
3. The Middle Fork John Day River population resides in the Middle Fork John Day and all its tributaries. Spawning areas in the Middle Fork John Day River are separated substantially from all other spawning areas; except for those in the North Fork John Day, that exhibit different habitat characteristics.

Project area status (John Day Basin Major Population Group) (ODFW 2009):

The population within the North Fork John Day River is considered "highly viable", with low or very low risk ratings. In comparison, the upper and lower mainstem John Day River, Middle Fork John Day River, and South Fork John Day River have medium risk ratings.

Table 2: John Day MPG status

Population Current Risk Status	**Population Current Risk Status**
North Fork John Day	Highly viable
Upper Mainstem John Day	Moderate risk
Lower Mainstem John Day	Moderate risk
Middle Fork John Day	Moderate risk
South Fork John Day	Moderate risk

The following are major limiting factors for the John Day River MPG:

Main limiting factors and threats:
- Degraded tributary habitat
- Mainstem passage
- Hatchery related effects
- Predation/competition/disease in mainstem and estuary

Within the analysis area, there are approximately 409 miles of designated critical habitat, dispersed throughout 15 watersheds.

Note: A detailed biological assessment (BA) is being completed for this species (see project record). Consultation with the National Marine Fisheries Service (NMFS) will be conducted.

Bull trout

Bull trout were listed by the USFWS as threatened under the federal ESA on June 10,

1998 (63 FR 31647). In 2010 critical habitat for bull trout was revised by the U.S. Fish and Wildlife Service, with many previously excluded streams within the analysis area becoming designated by the new rule (75 FR 63898, FWS-R1-ES-2009-0085). Bull trout are also a Malheur National Forest MIS.
The analysis area includes portions of both the John Day and Malheur bull trout species management units (SMUs).

Life History (USDI 2002): Bull trout have more specific habitat requirements than most other salmonids. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors. Bull trout are found in colder streams and require colder water than most other salmonids for incubation, juvenile rearing, and spawning. Spawning and rearing areas are often associated with cold-water springs, groundwater infiltration, and/or the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Alterations in channel form and reductions in channel stability result in habitat degradation and reduced survival of bull trout eggs and juveniles. Channel alterations may reduce the abundance and quality of side channels, stream margins, and pools, which are areas bull trout frequently inhabit. For spawning and early rearing bull trout require loose, clean gravel relatively free of fine sediments. Because bull trout have a relatively long incubation and development period within spawning gravel (greater than 200 days), transport of bedload in unstable channels may kill young bull trout. Bull trout use migratory corridors to move from spawning and rearing habitats to foraging and overwintering habitats and back. Different habitats provide bull trout with diverse resources, and migratory corridors allow local populations to connect, which may increase the potential for gene flow and support or refounding of populations.

Declines in bull trout distribution and abundance are the results of combined effects of the following: habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion structure or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that continue to depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development. Some threats to bull trout are the continuing effects of past land management activities.

Bull trout are present within both the Malheur River and John Day River drainages. Occupied waters within the John Day River drainage include: headwaters of the North Fork John Day River, Middle Fork John Day River, and upper mainstem John Day River and tributaries, with seasonal use of the mainstem river downstream to the vicinity of the town of John Day. The John Day River Recovery Unit Team has identified 12 extant local populations in the recovery unit. Within the Malheur River drainage occupied areas include: North Fork Malheur River and the Upper Malheur River subbasins, and the mainstem Malheur River from headwaters downstream to Namorf Dam.

Within the analysis area there are approximately 202 miles of designated critical habitat, dispersed throughout 6 watersheds within the John Day River and Malheur River drainages.

Note: A detailed biological assessment (BA) is being completed for this species (see project record). Consultation with the United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS) will be conducted.

Redband trout

Redband trout are currently on the Region 6 USFS sensitive species list, and are also considered a MIS species on the Malheur National Forest.

Life History: This is a resident form of rainbow trout, and exhibits habitat preferences similar to those for steelhead (described above). Redband trout may migrate within river systems, but do not migrate to the ocean.

Redband trout populations are widely distributed in all/most major stream drainages (and tributaries) within the Malheur National Forest, including the John Day River, Malheur River, and Silvies River.

Westslope Cutthroat Trout

Westslope cutthroat trout are currently on the Region 6 USFS sensitive species list, and are also considered a MIS species on the Malheur National Forest.

Life History (NatureServe 2013): Habitat includes small mountain streams, main rivers, and large natural lakes; requires cool, clean, well-oxygenated water; in rivers, adults prefer large pools and slow velocity areas (stream reaches with numerous pools and some form of cover generally have the highest fish densities); often occurs near shore in lakes. Juveniles of migratory populations may spend 1-4 years in their natal streams, and then move (usually in spring or early summer, and/or in fall in some systems) to a main river or lake where they remain until they spawn. Many fry disperse downstream after emergence. Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Spawns in small tributary streams on clean gravel substrate; mean water depth is 17-20 cm and mean water velocity is 0.3-0.4 m/sec; tends to spawn in natal stream. Adfluvial populations live in large lakes in the upper Columbia drainage and spawn in lake tributaries. Fluvial populations live and grow in rivers and spawn in tributaries. Resident populations complete the entire life history in tributaries. All three life-history forms may occur in a single basin. Migrants may spawn in the lower reaches of the same streams used by resident fishes. Maturing adfluvial fishes move into the vicinity of tributaries in fall and winter and remain there until they begin to migrate upstream in spring. Of migratory spawners, some remain in tributaries during summer months but most return to the main river or lake soon after spawning

Westslope cutthroat trout distribution is not precisely known, but is known to occur within the North Fork John Day River and upper mainstem John Day River (widely distributed).

Chinook salmon

Spring Chinook salmon are a Region 6 sensitive species. Essential Fish Habitat (EFH) for spring Chinook salmon has been designated by NMFS in the analysis area.

Life History (USDA 2008a): Salmon are sensitive to changes in water quality and habitat. Juvenile Chinook salmon are generally associated with pool habitats. An increase in sediment lowers spawning success and reduces the quantity and quality of pool and interstitial habitat. Other important habitat features include healthy riparian vegetation, undercut banks and large woody debris.

Adult spring Chinook salmon return to the main stem John Day River and Middle Fork John Day River during the spring. Spawning occurs within both drainages, with the majority in the Middle Fork John Day. Adults hold in deep pools during the summer while sexually maturing. Spawning occurs during fall, generally from August through September. Embryos incubate over the winter and emergence occurs the following spring. Juveniles generally rear for one year in freshwater. Juveniles use habitats with slower water velocities (pools, glides, and side channels). Juveniles overwinter in deep pools with abundant cover. Smoltification and emigration to the ocean occurs in the spring of their second year. The ocean rearing phase lasts from 1 to 3 years.

For this analysis, Essential Fish Habitat (EFH) for Chinook salmon is approximated by the distribution of steelhead, which includes most perennial streams within the John Day River drainage. Consultation with the National Marine Fisheries Service (NMFS) will be conducted.

Aquatic macroinvertebrates

Western ridged mussel (Jepsen et al. 2010): The western ridged mussel (*Gonidea angulata*) is widely distributed from southern British Columbia to southern California, and can be found east to Idaho and Nevada. G. angulate inhabits cold creeks and streams from low to mid-elevations. Hardhead, Pit sculpin and Tule perch are documented fish hosts for G. angulata in northern California, although little is known about the fish species that serve as hosts for this mussel throughout other parts of its range. G. angulata is sedentary as an adult and probably lives for 20-30 years, and thus can be an important indicator of habitat quality. G. angulata is a filter feeder that consumes plankton and other suspended solids, nutrients and contaminants from the water column. The large beds of G. angulata can improve water quality by reducing turbidity and controlling nutrient levels. Some Native American tribes historically harvested this animal and used it for food, tools and adornment. Populations of G. angulata have likely been extirpated in central and southern California, and it has probably declined in abundance in numerous watersheds, including the Columbia and Snake River watersheds in Washington and Oregon. The western ridged mussel belongs to a monotypic genus and thus should be considered a high priority for conservation. Lack of information on the western ridged mussel's current and historical abundance and distribution, and a lack of understanding of which host fish species it uses will impede conservation efforts.

Western ridged mussels have been documented in the Middle Fork John Day River drainage.

Note: Conclusions from the analysis for fishes will be used to qualitatively estimate effects for invertebrates since the aquatic species utilize the same habitat, and detailed distribution and habitat requirements are not well known for the invertebrates.

Table 3: Analysis watersheds fish species status

Watershed Name	HUC 5 code	Estimated Infested acres as of 2012	Percent of total near-stream area	Fish species*
Upper Middle Fork John Day River	1707020301	94.21	**1.50**	BT, CH, ST, RT
Pine Creek	1705011603	31.01	1.45	RT
Big Creek	1707020303	49.8	1.04	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	.96	CH, ST, RT, WT
Camp Creek	1707020302	94.96	.69	BT, CH, ST, RT
North Basin	1712000101	15.97	.51	RT
Beech Creek	1707020109	21.43	.48	CH, ST, RT, WT
Upper Malheur River-Griffin Creek	1705011605	1.64	.43	RT
Upper South Fork John Day River	1707020101	18.20	.43	RT

Watershed Name	HUC 5 code	Estimated Infested acres as of 2012	Percent of total near-stream area	Fish species*
Upper Silvies River	1712000201	19.63	.39	RT
Wolf Creek	1705011602	13.97	.33	RT
Little Malheur River	1705011612	4.88	.22	RT
Trout Creek	1712000203	19.86	.39	RT
Otis Creek	1705011606	2.15	.22	RT
Silvies Canyon	1712000205	4.97	.16	RT
Emigrant Creek	1712000206	9.79	.11	RT
Bear Creek	1712000202	1.47	.05	RT
Canyon Creek	1707020107	3.66	.05	CH, ST, RT, WT
Fields Creek	1707020111	1.52	.04	CH, ST, RT, WT
Cottonwood Creek	1707020209	3.84	.13	CH, ST, RT, WT
Upper Silver Creek	1712000403	.48	.02	RT
Upper North Fork Malheur River	1705011611	6.55	.10	BT, RT
Long Creek	1707020304	.64	.02	CH, ST, RT, WT
Upper John Day River	1707020106	4.69	.13	BT, CH, ST, RT, WT
Laycock Creek	1707020110	.87	.03	CH, ST, RT, WT
Lower North Fork John Day River	1707020210	.17	.00	CH, ST, RT, WT
Murderers Creek	1707020104	1.30	.02	CH, ST, RT, WT
Upper Malheur River	1705011601	6.50	.09	BT, RT
Strawberry Creek	1707020108	.44	.01	BT, CH, ST, RT, WT
Buck Creek	1707030303	0.00	0.00%	RT
Claw Creek	1712000402	0.00	0.00%	RT
Desolation Creek	1707020204	0.00	0.00%	RT
Granite Creek	1707020202	0.00	0.00%	RT
Grindstone Creek	1707030306	0.00	0.00%	RT
Headwaters Silver Creek	1712000401	.17	0.00%	RT
Lower South Fork John Day River	1707020105	0.00	0.00%	CH, ST, RT, WT
South Fork Beaver Creek	1707030307	0.00	0.00%	RT
Twelvemile Creek	1707030305	0.00	0.00%	RT
Willow Creek	1712000207	0.00	0.00%	RT
		Total: 462		

* Estimate of potential presence: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout

General Aquatic Conditions (excerpt from USDA 2008b)

In the discussion below, the hydropower development and habitat alteration sections are relevant to all ESA listed aquatic species, as well as other aquatic species of special conservation concern. The hatcheries and harvest sections are more relevant to salmon and steelhead, but do have infrequent adverse effects to bull trout.

Hydropower Development

Numerous river systems in Washington and Oregon have been affected by hydropower development. The hydropower development on the Columbia and Snake Rivers are perhaps the best documented and most dramatic example. Numerous aquatic species throughout the basin have been affected. Storage dams have eliminated spawning and rearing habitat for salmon and other species, and altered the natural hydrograph of the Snake and Columbia Rivers – decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate – slowing fish movement through reservoirs, altering riparian ecology, and stranding fish in shallow areas. The 13 dams in the Snake and Columbia River migration corridors kill salmonid smolts and adults and alter their migrations. The dams have also converted the once-swift river into a series of slow-moving reservoirs – slowing the smolts' journey to the ocean and creating habitat for predators. Because most of the ESA listed salmon and steelhead in the Columbia River system must navigate at least one, and up to nine major hydroelectric projects during their upstream and downstream migrations (and experience the effects of other dam operations occurring upstream from their ESU/DPS boundary), they experience the influence of all the impacts listed above. Numerous other river systems within the Pacific Northwest contain dams which block migrations or affect habitat for salmon, bull trout, and other aquatic species. Many dams were constructed without fish passage facilities, and have resulted in a sizeable loss of accessible habitat for salmon and steelhead, and disruption of meta-population connections for some inland fish species. Numerous smaller dams also exist that block migrations on smaller rivers or tributaries. Improvements for some hydropower dams affecting ESA listed fish species in the Pacific Northwest have been and are occurring. Ongoing consultations between NOAA Fisheries and Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), USFWS, and the Bureau of Reclamation (BOR) have brought about numerous beneficial changes in the operation and configuration of the Columbia River hydropower system. For example, in most years increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Snake and Columbia Rivers provides better in- river conditions for smolts; and better smolt transportation (through the addition of new barges and by modifying existing barges) helps the young salmonids make their way down to the ocean. In the case of Snake River spring/summer Chinook salmon smolts migrating in river, the estimated survival through the hydropower system is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of 5 to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer Chinook salmon. Similar spill modifications are occurring at dams located in a number of river systems throughout the Pacific Northwest that are designed to benefit both inland and anadromous fish species.

In addition, Federal Energy Regulatory Commission (FERC) relicensing of hydropower dams throughout the Pacific Northwest is also likely to result in some operational, structural, or offsite mitigation benefits for ESA listed aquatic species. For example, ongoing FERC relicensing discussions for Pelton Dam on the Deschutes River may result in reconnection of bull trout populations in the lower Deschutes River with a stronger upstream population in the Metolius River.

Human-induced Habitat Degradation

The quality and quantity of fresh water habitat in much of Oregon and Washington have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and housing/urban development have radically changed the historical habitat conditions within the Pacific Northwest. More than 2,500 streams, river segments, and lakes in the Northwest do not meet federally-approved, state, and/or Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Water quality problems are caused by a variety of activities such as urban development, forestry, farming, livestock grazing, riparian/channel alteration, road systems, and dams and other types of water management.

Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Many waterways in Oregon and Washington fail to meet Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins and other pollutants. These pollutants originate from both point - (industrial and municipal waste) and non-point (agriculture, forestry, urban activities, etc.) sources. The types and amounts of compounds found in runoff are often correlated with land use patterns: Fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution within the Pacific Northwest, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among areas with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water. Salmon and steelhead require clean water and gravel for successful spawning, egg incubation, and fry emergence. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Pollutants, excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon, steelhead, and bull trout.

Many locations within Oregon and Washington are productive agricultural areas. At least 35 economically important crops are grown, including grass seed, wheat and other grains, several vegetables, various berries, fruits, nuts, and Christmas trees and other nursery products. Approximately 250-300 different pesticides are applied in Oregon, with a total of about 13.4 million pounds of active ingredient applied annually during 1990-1996. These totals do not include pesticides applied in urban areas, rangelands, along road right-of-ways, or forestry uses. Insufficient information is available regarding fate and transport of these chemicals to make a reasonable assessment of how much of the pesticides were delivered to aquatic habitat. However, given the sheer quantity of pesticide applications, it is very likely that exposure of ESA listed species to these chemicals occurs. The U.S. Geological Service (USGS) confirmed that many different pesticides can be found in small Willamette Valley streams in Oregon and are consistently making their way into the aquatic environment, and degrading water quality; therefore, it is assumed that many pesticides also make their way into the Snake and Columbia River systems.

Pollutant content of urban runoff can vary considerably, but generally includes organic compounds, metals, sediments, nutrients, and microbes. Organic compounds can include oils, grease, phthalates, chlorinated hydrocarbons, pesticides, and other compounds. Metals often found in urban runoff include lead, copper, and zinc. Sediment in urban runoff can be particularly problematic due to the fact that many other pollutants are delivered to the aquatic environment via adsorption to eroded sediments. Nutrients typically included are nitrogen and phosphorus. A wide variety of microbes can be delivered in urban runoff, including many different types of bacteria, protozoa, and viruses.

Chemical use in state, federal, and private forest lands have resulted in the introduction of pollutants to headwater stream segments. The three major categories of forest chemical used are pesticides, fertilizers, and fire retardants. While pesticide use in all forest ownership types was extensive during the 1970's and 1980's, application rates on National Forest System lands peaked in the mid 1980's, and have decreased considerably since.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in Washington and Oregon are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for some ESUs that have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In fact, in 1993, fish and wildlife agencies, Tribal, and conservation group experts estimated that 80 percent of 153 Oregon Columbia River tributaries had low-flow problems, two-thirds of which was caused (at least in part) by irrigation withdrawals. The Northwest Power Planning Council found similar problems in many Idaho, Oregon, and Washington tributaries.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Being diverted into unscreened or inadequately screened water conveyances or turbines sometimes kills migrating fish. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout basins in the Region.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, floodplains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil, thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the area's habitat and land-use changes. Federal lands are generally forested and situated in upstream portions of the watersheds. While there has been substantial habitat degradation across all land ownerships, including Federal lands, in general, habitat in many headwater stream segments is in better condition than in the largely non-federal lower portions of tributaries. In the past, valley bottoms were among the most productive fish habitats in the basin. Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valleys and lower elevation areas. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

As some habitats were being compromised by water withdrawals, water impoundments in other areas dramatically reduced habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, frequently to a single channel. Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced.

Estuary habitat throughout Washington and Oregon has been adversely affected through a variety of processes. The Columbia River estuary, for example, through which all the basin's anadromous species must pass, has been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment of multiple channels, extensive wetlands, sandbars, and shallow areas. Historically, the mouth of the Columbia River was about four miles wide; today it is two miles wide. Previously, winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased. Many other estuaries throughout the area have experienced some combination of similar effects.

Human-caused habitat alterations have also increased the number of predators feeding on ESA listed species. For example, a population of terns on Rice Island (16,000 birds in 1997) in the Columbia River consumed an estimated 6-25 million emigrating salmonid smolts during 1997 and 7-15 million emigrating smolts during 1998. Rice Island is a dredged material disposal site in the Columbia River estuary; the Corps created it under its Columbia River Channel Operation and Maintenance Program. As another example, populations of Northern pike minnow (*Ptychocheilus oregonensis*) in the Columbia River have proliferated in the warm, slow-moving reservoirs created by the mainstem dams, and prey heavily on juvenile salmonids. Some researchers have estimated the pike minnow population in the John Day pool alone to be more than one million. In other river systems, such as the John Day, Umpqua, and Snake Rivers, non-native predators such as smallmouth bass (and others) have been introduced, prey on a variety of native aquatic species, and thrive in high numbers.

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to: (1) produce fish for harvest, and (2) replace natural production lost to dam construction and other development – but, until recently, not to protect and rebuild naturally-produced salmonid (or other native fish) populations. As a result, most salmonid populations in much of the Pacific Northwest are primarily derived from hatchery fish. In 1987, for example, 95 percent of the Coho salmon, 70 percent of the spring Chinook salmon, 80 percent of the summer Chinook salmon, 50 percent of the fall Chinook salmon, and 70 percent of the steelhead returning to the Columbia River basin originated in hatcheries. Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examining their own effects on local populations), it is only recently that the substantial effects of hatcheries on native natural populations been documented. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in natural Coho salmon runs in the lower Columbia River over the past 30 years.

Hatchery fish can harm naturally-produced salmon and steelhead in four primary ways: ecological effects, genetic effects, overharvest effects, and masking effects. Ecologically, hatchery fish can predate on, displace, and compete with wild fish. These effects are most likely to occur when young hatchery fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Humans taking native fish from one area and using them in a hatchery program in another area can also cause interbreeding. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there. In many areas, hatchery fish provide increased fishing opportunities. However, when natural fish mix with hatchery stock in these areas, smaller or weaker natural stocks can be overharvested. Moreover, when migrating adult hatchery and natural fish intermix on spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated because the hatchery fish mask the surveyors' ability to discern actual natural run conditions.

Bull trout are incidentally affected by hatcheries due to weirs, ladders, and water removal that effect passage and handling of individuals in areas where they overlap with salmon and steelhead.

Harvest

Salmon, steelhead, and several inland fish species have been harvested in the Oregon and Washington areas as long as people have been present. These harvests were a major food source for the native populations, and included non-game fish such as Lost River and shortnose suckers. Commercial salmon (and Lost River sucker) fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Native American fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800's and took place primarily in tributary locations.

Salmon and steelhead have formed a major component of recreational fisheries for decades. Conservation concerns for natural salmon and steelhead populations have caused regulations to be put in place in Oregon and Washington that strictly limit the number of fish anglers may catch and the types of gear that may be used in many areas. Incidental catch of bull trout occurs from recreational sport harvest.

Initially, the non-Native American fisheries targeted spring and summer Chinook salmon, and these runs dominated the commercial harvest during the 1800's. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer Chinook salmon exceeded 80 percent (and sometimes 90 percent) of the run—accelerating the species' decline. From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring

Chinook salmon run and appeared to have a minimal effect on subsequent returns. Until the spring of 2000, when a relatively large run of hatchery spring Chinook salmon returned and provided a small commercial tribal fishery, no commercial season for spring Chinook salmon had taken place since 1977. Present Columbia River harvest rates are very low compared with those from the late 1930's through the 1960's. Although steelhead were never as important a component of the Columbia Basin's fisheries as Chinook, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to declines in all of the 12 ESUs under discussion in this analysis.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management. As with improvements being made in other phases of salmon and steelhead life history strategies, it will take some time for these (and future) measures to contribute greatly to the species recovery, but the effort has begun.

Ocean harvest for other species has also affected salmon and steelhead populations, though only incidentally and to an essentially unknown degree. For example, at one point it was estimated that unauthorized high seas drift net fisheries harvested between 2 percent and 38 percent of steelhead destined to return to the Pacific Coast of North America. However, since drift nets were outlawed in 1987, and enforcement has increased, that percentage has certainly decreased greatly. Therefore, it is indeterminable to what degree by-catch affects any of the listed salmon and steelhead ESUs, but is probably a fairly minor impact in comparison to the effects on these ESUs arising from other anthropogenic sources.

Water Quality (from project hydrology section)

There are 6,220 mapped miles of stream channel on the Forest. About 2, 788 miles or 45 percent of the total is mapped as perennial, meaning flow is typically sustained beyond the influence of wet season or snowmelt through most of the year.

Section 303(d) of the Clean Water Act (1972) requires that the state list water bodies, on biennial basis that do not meet minimum requirements for stated beneficial uses. The State of Oregon Department of Environmental Quality is the responsible agency for assessing and listing impaired streams. As of this writing the 2012 report was not complete. The 2010 list is referenced (http://www.deq.state.or.us/wq/assessment/assessment.htm). Category 5A streams are those listed and needing an EPA approved Total Maximum Daily Load (TMDL) of pollutant allowed to meet water quality standards. Category 4A streams are those that have approved TMDL, and have subsequently been de-listed from the 303(d).

Category 4A streams within the Forest boundary are the John Day River system, including the Middle Fork and South Fork and their tributaries with approved TMDL for temperature. Issues are water temperature for life stages of red band and cut throat trout. Category 5A streams are within the Silvies River system and include Hay, Myrtle and Skull Creeks for water temperature; and within Silver Creek system: Nicoll, Claw, Sawmill, Salt Canyon and main-stem Silver for water temperature.

Other streams listed yet with insufficient information are the Middle Fork John Day and the following tributaries: Long Creek, Deadwood, and Vinegar for bio-criteria, Long and Summit Creeks for sediment. The Silvies River and following tributaries: Camp, Bear Canyon, Van Aspen Antelope for bio-criteria, and main stem Silvies for dissolved oxygen. Finally the upper John Day River is listed for bio-criteria, dissolved oxygen and sediment.

Table 4: Water quality within analysis area

Category 5A	**Category 4A**	**Insufficient Information**		
Temperature	*Temperature*	*Dissolved Oxygen*	*Bio-criteria*	*Sediment*
Silvies R. and Silver Crk.	M. and S. Fk. John Day R. and tributaries	Up. John Day R.; Silvies R.	M. Fk. John Day R. and tributaries (Long, Deadwood and Vinegar crks); Up. John Day R.; Silvies R. and tributaries	Up. John Day R., Long and Summit Cks. on M. Fk. John Day R.

Desired Condition

Desired conditions for aquatic species of special conservation concern are primarily defined by the forest plan and amendments. For the Malheur National Forest, PACFISH/INFISH standards apply, and amend/supersede those within the forest plan.

Malheur National Forest Land and Resource Management Plan (USDA 1990)
Approximately 215,000 acres of old-growth habitat occurs across the Forest. This includes 47,690 acres of dedicated old growth stands and 25,000 acres of replacement old growth stands distributed across managed forest lands. Riparian areas, visual corridors and semi-primitive unroaded areas provide travel routes between old growth units.

Many of the recently harvested riparian area stands of lodgepole pine will have been reestablished and will have attained sufficient size to once again provide shade and water temperature regulation in the affected streams.

Wildlife species which utilize riparian areas will be responding positively to improved riparian vegetation conditions. The production of both anadromous and resident fish will be greater than it is now. Smolt habitat capability for Chinook salmon and steelhead trout will have increased to approximately 350,000 smolts. Most of the identified structural habitat improvement work on anadromous streams will have been completed (approximately 30 structures per year). Substantial work will also have been accomplished on resident streams (approximately 50 structures per year).

Approximately 8,000 acres of fish and wildlife habitat improvements will have been completed by the end of the first decade. The types of improvements which will have occurred include prescribed burning, seeding, browse planting, pruning, mechanical disturbance, and fertilizing to enhance forage production. Other projects will include aspen stand enhancement and riparian vegetation plantings.

PACFISH and INFISH

PACFISH and INFISH primarily use attainment of Riparian Management Objectives (RMO) to define desired conditions. These may be modified to increase suitability to local conditions.

Quantifiable measures of stream and stream-side conditions that define good fish habitat, and serve as indicators against which attainment or progress towards attainment of goals will be measured. Riparian Management Objectives developed in the interim for landscape scale assessment describing good habitat for fish are to be applied at the watershed scale for streams of moderate to large size (3rd to 6th order streams). The indicators are:

1) Pool Frequency (all systems; PACFISH & INFISH) – varies by channel width

Wetted width (ft)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

2) Water Temperature –

No measurable increase in maximum water temperature (7 day moving of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period).

Maximum water temperatures remain below 59°F within adult holding habitat and below 48°F within spawning and rearing habitats.

3) Large Woody Debris INFISH – East of Cascade Crest in OR, WA, ID, NV, and western MT: > 20 pieces per mile; > 12 inch diameter; > 35 foot length.

4) Bank Stability (non-forested systems PACFISH & INFISH) - > 80 percent stable.

5) Lower Bank Angle (non-forested systems PACFISH & INFISH) - > 75 percent of banks with < 90 degree angle (i.e., undercut)

6) Width/Depth Ratio (all systems PACFISH & INFISH) - < 10 (mean wetted width divided by mean depth)

<u>Water Quality and Quantity – State and other Federal</u>

Federal and state requirements related to desired condition for water quality/quantity are addressed in the project hydrology report.

Environmental Consequences

Methodology

The fisheries analysis is tiered to programmatic documents such as PACFISH and INFISH, and the R6 2005 FEIS. At the project scale, the different treatment methods were mapped and overlaid with fish distribution to see if potentially harmful treatments might occur in proximity to habitat for aquatic species of conservation concern. The analysis on treatments is focused within infested areas that lie within 100 feet of aquatic habitat. [1]

Analysis includes consideration of effects at the infested site scale and also at various watershed scales to determine relative risk to fish from the project. The SERA Risk Assessments and GLEAMS model (see Soil and Water section above for details) were used to determine whether herbicide use could result in measurable delivery of herbicide to the stream. For all treatment types (herbicide and non-herbicide), it the potential for ground disturbing activity that could result in sediment delivery to a stream was considered.

The spatial analysis boundary for aquatics effects are is the administrative boundary of the Malheur National Forest. Detectable effects, such as increased turbidity resulting from sediment created by the project, are not expected to extend beyond the Malheur National Forest boundary. The temporal boundary for analysis extends 15 years into the future (the life of the project). "Short-term" effects refer to the time period within 2 years of site-specific (e.g., within a watershed) implementation, with "long-term" extending from 2-15 years. The spatial and temporal boundaries are identical for all effects: direct, indirect, and cumulative.

PACFISH-INFISH RMOs (see desired condition above) were considered to determine whether there is any potential effect that could be influenced by invasive plant treatment, specifically herbicide use, since RA-3 requires that herbicide not retard or prevent habitat from meeting RMOs. RA-3 also requires that adverse effects on inland and anadromous fish be avoided. Progress toward maintaining and restoring good fish habitat is measured at the 3rd to 6th order streams scale within 6th field watersheds, based on measurable indicators of good fish habitat.

[1] If any part of the infested area is within 100 feet of a stream or other water body, the entire area is considered a "riparian unit" even if only a portion of the infested sites is near the water body.

The indicators are pool frequency, water temperature, amount of large woody debris, bank stability, lower bank angle of the creek, and width to depth ratio. Invasive plant treatments have low potential to affect any of these indicators, and would complement other habitat restoration actions. Invasive plant treatments do not have the potential to influence pool frequency or retard development of pools. Invasive plant treatments have no potential to affect recruitment of large woody debris and would complement other habitat restoration efforts by removing competition between invasive plants and native woody vegetation. Invasive plant treatments are highly unlikely to measurably affect water temperature because invasive plants provide little or no understory shade, and no overstory shade. Invasive plant treatments could help restore native vegetation that provides shade. Invasive plant treatments have low potential to adversely affect bank stability, especially at a meaningful scale, because 1) native vegetation usually provides better bank stability than invasive plants and 2) the project design and project caps limit treatment within riparian areas to 50 acres per 6^{th} field watershed (of which only ten acres may include herbicide use). Given these factors, there is little likelihood that invasive plant treatments would adversely affect bank stability or retard recovery efforts. Neither invasive plants, nor invasive plant treatments have the potential to affect bank angle or width to depth ratio and there would not retard recovery of these habitat indicators. Given the low likelihood of adverse effects on these indicators, information on existing stream conditions relative to these indicators was not assembled for this report. Discussion about potential effects on inland and anadromous fish species is included throughout this report are relevant to the finding of consistency with PACFISH/INFISH.

Note: Analyses for Alternatives C and D will be addressed through comparing and contrasting the potential differences in effects with the analysis for Alternative B, which is the preferred alternative.

Analysis Method

- Determine distribution of TES aquatic species within Project Area.
- Identify overlap areas of proposed invasive plant treatment areas and TES species occupation.
- Identify proposed method of treatment and proximity of invasive plant site to water.
- Determine potential effects to aquatic species by method of invasive plant treatment.
- Describe aquatic risks from herbicide (GLEAMS model).
- Determine likelihood that aquatic species will occur within or adjacent to invasive plant site to be treated.
- Determine effects to aquatic species from proposed method.

The indicators used to compare the effects of the alternatives is acres of treatment within aquatic buffers (100 feet of potential fish-bearing streams) by herbicide or combination of herbicide and other treatment methods. A watershed-based approach will be used for the purpose of identifying general areas with estimated differences in relative risk (e.g., high, medium, low). Determination of effects due to treatment method is evaluated by:

- SERA Risk Assessments and GLEAMS model (from project hydrology report)
- Acres of herbicide treatment within 100 feet of waters potentially occupied by aquatic species.

- Erosion and /or sedimentation- acres of potential ground disturbing activity within 100 feet of water occupied by aquatic species.

Incomplete and Unavailable Information

The distribution of aquatic organisms throughout the entire analysis area (forest administrative boundary) is not precisely known. The locations of actual treatment could change over time as new sites of invasive plants are discovered or known sites change in size. To ensure that the analysis covers conditions subject to change over time (see Early Detection and Rapid Response discussion in Chapter 2), treatment sideboards and caps, and other layers of caution were added to ensure that the analysis describes a maximum treatment scenario in terms of adverse effects to aquatic species of concern. Thus, although the precise locations, timing and specific treatment methods in any watershed may vary, the impacts have been considered sufficiently in this analysis.

Spatial and Temporal Context for Effects Analysis

The spatial analysis boundary for aquatics effects are is the administrative boundary of the Malheur National Forest – detectable effects, such as increased turbidity resulting from project-related sediment mobilization, are not expected to occur downstream of the forest boundary. The temporal boundary for analysis extends 15 years into the future. "Short-term" effects refer to the time period within 2 years of site-specific (e.g., within a watershed) implementation, with "long-term" extending from 2-15 years. The spatial and temporal boundaries are identical for all effects: direct, indirect, and cumulative.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Cumulative effects are the result of incremental impacts of the proposed actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on National Forest System lands and adjacent federal, state, or private lands (40 CFR 1508.7). The baseline for cumulative effects analysis is the current condition as described in the affected environment section above.

Herbicides are commonly applied for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Studies (see Chapter 3 of EIS) have shown that pesticides are commonly found in surface waters in Oregon and throughout the United States. However, the studies indicate that herbicide use similar to the type proposed in this project would not result in harmful concentrations of herbicide in water. These potential additions will be analyzed qualitatively based on percentage of non-national forest lands present within specific watersheds.

Sediment production from project actions could add to sources derived from other actions on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. These potential additions will be analyzed qualitatively based on percentage of non-national forest lands present within specific watersheds.

Current and reasonably foreseeable actions on national forest lands are listed in Appendix B. Actions that could add to potential project effects (e.g., sediment production) are addressed qualitatively within the analysis below for each alternative.

Alternative 1 – No Action

Direct, indirect and Cumulative Effects

Since no action would occur, there are no direct, indirect, or cumulative effects associated with choosing the no action alternative.

Direct effects occur at the same time and place as a FS action; because no action would occur under this alternative, there would be no direct effects. Indirect effects are effects associated with an action that occur at a place or time distant from the action; because no action would occur under this alternative, there would be no indirect effects. Cumulative effects are effects associated with an action that combine with other actions/natural ground disturbing events to create a larger, more intense, or different impact to a particular resource.

Consequences of No Action

Native vegetation supports the biotic (e.g., invertebrate community) and abiotic (soil stabilization) attributes necessary for high quality aquatic habitat. Though uncertainty exists, it is likely that continued expansion of invasive plants, as would likely occur with no action, would change near-stream biotic and abiotic attributes, and would be undesirable for all/most aquatic species.

Habitat indicators such as bank stability and water temperature may be influenced by the presence of invasive plants that out-compete or inhibit growth of native woody vegetation that provide rooting structure and shade. Riparian habitat and the aquatic food chain may be negatively impacted by the presence of invasive plants by limiting the development of native vegetation with which aquatic organisms evolved.

Alternative B – Proposed Action (summarized from Chapter 2 of EIS – see EIS for detailed description)

Alternative B, the proposed action, is our proposal as the most cost-effective approach to invasive plant treatment while minimizing the adverse effects of treatment according to the Malheur National Forest LRMP as amended R6 2005 ROD. The Responsible Official has identified alternative B as the Preferred Alternative.

We inventoried the invasive plants across the Malheur National Forest and identified common control measures for the 18 primary target species found. The common control measures include a range of integrated treatment/restoration methods that could be implemented across a range of infested sites. We will identify the specific manual, mechanical, biological, herbicide and cultural/restoration treatments to be implemented at the time of treatment.

In addition to the common control measures, we developed project design features and herbicide-use buffers for alternative B. The project design features and herbicide-use buffers are intended to minimize adverse effects of treatment and follow national Best Management Practice guidelines for chemical uses on national forests.

To develop the common control measures, project design features, and herbicide-use buffers, we considered the best available scientific information about invasive plant management. Our primary sources come from the R6 2005 FEIS, the most current herbicide and adjuvant risk assessments, professional journal articles and other information published since 2005. The literature cited section of chapter 4 documents our commitment to using best available science and high quality data.

Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Malheur National Forest over the next 5 to 15 years. These options are intended to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants. The project would continue to be implemented each year until the treatments were no longer needed or conditions substantially change on the ground to such a degree that the analysis in this EIS is no longer valid. The annual implementation planning process later in this chapter (section 2.4.2) discusses how changed conditions would be evaluated for this project over time.

Aminopyralid would be used for the first year or so of treatment for about 1,350 acres (64 percent of the total infested acreage). This herbicide is likely to be the most effective of the 11 available herbicides for 13 of the 18 primary target species (all except houndstongue, toadflax, pepperweed and whitetop, which have chlorsulfuron as the first-choice herbicide; and sulphur cinquefoil, that has metsulfuron methyl as the first-choice herbicide). Other effective herbicides could be used as needed over time, depending on whether the first year's choice proved effective.

Alternative B responds to public concerns about treatment effectiveness by authorizing a wide range of integrated treatment methods that would be prioritized, planned and implemented in cooperation with our neighbors. We would start to use herbicides and redistribute biological control agents on the Forest as soon as practicable after the NEPA decision. Alternative B is, by definition, the most cost-effective alternative.

Alternative B favorably responds to issues about effects of herbicides on human health, non-target vegetation and pollinators, soils, water, aquatic organisms, wildlife, and special places because treatments would be implemented according to design features and herbicide-use buffers that minimize the risk of adverse effects.

Changes Made to Alternative B For the Final EIS

Some changes were made to alternative B since release of the Draft EIS. These changes are generally intended to help respond to public comments.

- PDF B1: Included coordination for herbicide use within municipal watersheds.
- PDF F1: No use of POEA or NPE-based surfactants.
- PDF F2: Drop reference to NPE. Limit spot spray of triclopyr to typical rates per acre. Clarify that herbicide rates are measured on a per acre basis.
- PDF H4: Include picloram, imazapyr and metsulfuron methyl as herbicides that would only be used once every other year (increased from once per year). Include aminopyralid to use only once per year. This change was made to address concerns about potential persistence of these herbicides under some soil/climate conditions.
- PDF H10: Minor clarification.
- PDF I4: Clarify PDF. Previously it had a redundancy with the H group regarding run off of some herbicides.
- PDF J13 was added to provide protection measures for the yellow-billed cuckoo.
- PDFs L2-L4: Forest product gathering areas are not mapped so there was concern that these pdfs would not be implementable as written in the draft. The changes to these pdfs ensure that areas identified by the public will be prominently posted. PDF L2 and L3 were combined into one PDF (L2) and reference to the spiritual dimension related to herbicide use and plant collection was added.

Other changes:

- The statement has been added that passive restoration may include keeping cattle away from treated areas until the area has recovered and contains desirable vegetation.

- A project cap for all treatment methods except biological controls has been added to ensure that no more than 50 acres per year would be treated within 100 feet of a water body in any 6th field watershed. Of the 50 acres, no more than 10 acres would be treated with herbicide.
- Herbicide use buffers have been modified to include roadside ditches that are hydrologically connected to streams, when surface water is present in the ditch.
- The biological control agents table has been updated to 1) explain that a previously released thistle agent is not approved for R6 and 2) omit agents that have not been effective in eastern Oregon.
- The Risk Assessment Year and Reference table has been updated to include 2011 assessments for imazapyr, picloram, and triclopyr.

This section has been reorganized for clarity and additional information about treatment methods has been included.

Land and Resource Management Plan Amendment

We are proposing a Land and Resource Management Plan amendment to add aminopyralid to the list of acceptable herbicides for use as part of the integrated treatment toolbox for invasive plants on the Malheur National Forest. Aminopyralid (also known by the trade name: Milestone®) was not available during the analysis process for the R6 2005 FEIS. The risk assessment completed in 2007 indicates that this herbicide will increase treatment effectiveness and decrease risk of adverse effects as compared to other herbicides authorized in the R6 2005 ROD. Thus, we propose to add aminopyralid to the list of approved ingredients in invasive plant standard 16 for the Forest (non-significant LRMP amendment). All other standards and guidelines for invasive plant management would remain the same (see chapter 1).

U.S. EPA (2005) has concluded that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species:

> "Aminopyralid is a Reduced Risk herbicide that provides reliable control of a broad spectrum of difficult-to control noxious weeds and invasive plants on rangeland and pastures, rights-of-way, and wildlife habitat areas. Aminopyralid is particularly effective for the control of tropical soda apple, musk thistle, Canada thistle, spotted knapweed, diffuse knapweed, yellow starthistle and Russian knapweed. Aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates, compared to the alternatives, and is less likely to impact both terrestrial and aquatic plants."

Currently Standard 16 reads:

> *Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Malheur National Forest LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.*

We propose to amend Standard 16 to read:

> *Select from herbicide formulations containing one or more of the following 11 active ingredients: **aminopyralid**, chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl,*

picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Malheur National Forest LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.

Invasive Plant Treatment Methods Authorized Under Alternative B

The following description summarizes important information about the treatment methods that are proposed for alternative B.

Proposed treatment methods descriptions

Treatment Method	Description
Manual	Includes hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Other manual methods could include hot water steaming and solarization techniques such as using black plastic to cover invasive plants to shade out and kill pieces of roots (i.e. rhizomes). These techniques could be used where minimizing herbicide use is desirable such as streambanks or near sensitive plant populations.
Mechanical	Mechanical methods use power tools and include such actions as mowing, weed whipping, road brushing, and root tilling. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas.
Biological Agents	Biological agents are parasitic insects, mites, nematodes, and pathogens that feed on specific parts of invasive plants and inhibit their growth and spread. In some situations, a suite of biological control agents is needed to reduce weed density to a desirable level. For instance, a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically 15 to 20 years are needed to suppress or contain an established population of invasive plants. Agents approved by the Animal and Plant Health Inspection Service (APHIS) that are proven natural control agents of specific invasive species but do not harm other species may be released.
Cultural Methods/ Restoration	Cultural controls are defined in the R6 2005 FEIS as: "The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants" (page 10). In this project, the following cultural treatments are not included: livestock grazing[1], burning, tilling, plowing and mechanical seed drilling. Mulching, seeding, planting would be used to encourage native plant survival and re-establishment, speed reoccupation of a site by native vegetation, and provide erosion protection. Restoration of native plant communities through mulching, seeding or planting would be likely to occur as a follow up to invasive plant treatment in areas where passive restoration is not sufficient. This will be determined as a part of each treatment prescription. The 1,281 acres that are of a size and configuration to potentially warrant broadcast spraying are assumed to need some sort of restoration in this analysis. Please note that passive restoration could be sufficient in many of these areas, or restoration could be needed elsewhere.
Herbicide Application: General	Herbicides would be used to contain, control and eradicate invasive plants that are not cost-effectively treated by other methods. When herbicide use is proposed to occur in or near sensitive areas, specific design features would be used to insure that vegetation treatments do not have an adverse impact on non- target plants or animals. Herbicide treatments, chemical mixing, spill prevention, and clean up would be done in accordance with Forest Service policies, plans and product label requirements.
Herbicide Application: Broadcast Spraying	Broadcast application means that herbicide is applied to a continuous population of invasive plants. This method is used when the weed is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. Larger and denser infestations may require a broadcast spray. In cases where the invasive plant covers more than 70 percent of an area that is bigger than 0.1 acre, broadcasting may be the most cost-efficient method. The most ambitious conceivable situation would be all currently infested areas become 100 percent covered with invasive plants, which would require the full amount of herbicide to be broadcast on each acre at a typical rate. Using this assumption for this analysis, about 1,281 acres would meet the criteria for broadcast spraying under alternative B. Many project design features are proposed to avoid drift and other risks

Treatment Method	Description
	sometimes associated with broadcast spraying. Broadcast spraying using most of the 11 herbicides is not allowed near streams (with the exception of aminopyralid which poses low risk to fish and aquatic invertebrates).
Herbicide Application: Spot and Selective Spraying	Selective application targets individual plants. Herbicide is usually applied by hand. Spot spraying targets clumps of plants. Herbicide is usually applied with a backpack sprayer or other hand pump system. Spot spraying is also done using a hose off a truck-mounted or ATV-mounted tank. The most ambitious conceivable situation would be that all currently infested areas become 100 percent covered with invasive plants; however, the size of these infestations would not require broadcast treatment. Therefore under this scenario about 843 acres would be treated using selective or spot application methods.

[1] Grazing would be managed to prevent invasive plant introduction, establishment and spread and may reduce existing populations. These actions would be managed under appropriate grazing management plans. Prescribed burning would also address prevention of the spread of invasive plants and could reduce the size of target populations. However, no grazing or burning is proposed for this project.

Table 5: Alternative summary for known infested sites

	Alt B (Proposed Action)	Alt C	Alt D
Broadcast	**1280.95**	**543.13**	**543.13**
Aminopyralid	1179.49	441.67	0.00
Chlorsulfuron	71.25	71.25	435.18
Glyphosate	0.00	0.00	3.15
Metsulfuron methyl	30.22	30.22	68.96
Picloram	0.00	0.00	35.83
Spot	**842.86**	**191.42**	**1580.68**
Aminopyralid	167.86	117.95	0.00
Chlorsulfuron	519.05	70.89	594.70
Glyphosate	0.00	0.00	721.59
Metsulfuron methyl	155.95	2.57	237.62
Picloram	0.00	0.00	26.77
Manual_Mechanical	0.00	**1389.26**	0.00
Grand Total	**2123.81**	**2123.81**	**2123.81**

Table 6: Invasive plant target species and herbicide preferences

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	aminopyralid	clopyralid glyphosate picloram	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority. Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	aminopyralid	glyphosate metsulfuron methyl picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	metsulfuron methyl	glyphosate picloram triclopyr	Cultural treatments such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	aminopyralid	clopyralid chlorsulfuron glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Spotted knapweed *Centaurea stoebe ssp. Micranthos* (CESTM) Taprooted perennial	aminopyralid	clopyralid glyphosate triclopyr picloram	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Diffuse knapweed *Centaurea diffusa* (CEDI) Short-lived perennial, biennial or annual. Often with a long, stout taproot	aminopyralid	clopyralid glyphosate picloram triclopyr	
Squarrose knapweed *Centaurea ulfome ssp. Squarrosa* (CEVIS2) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	
Meadow knapweed *Centaurea jacea sensulato* (CEJA) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	aminopyralid	clopyralid chlorsulfuron picloram	Combining mechanical, cultural, biological, and chemical methods is best for effective control Biological agents are available, but use may affect native thistles. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle*	aminopyralid	clopyralid chlorsulfuron glyphosate	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Cirsium vulgare (CIVU) Taprooted biennial		picloram triclopyr	as they are found. Manually pulling rosettes or cutting stems 2”-4” below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations. (please note, this was described as the “Canada thistle strategy”) in the DEIS.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	aminopyralid	glyphosate imazapic picloram	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years). Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
			and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	chlorsulfuron	metsulfuron methyl imazapic	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1 – 2 inches below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots	chlorsulfuron	metsulfuron methyl imazapic picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system. If biocontrol agents continue to be effective, herbicide application may not be needed.
Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots	chlorsulfuron	metsulfuron methyl imazapic picloram	
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial	chlorsulfuron	metsulfuron methyl glyphosate imazapic imazapyr	These species are difficult to control because of its deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control. Frequent monitoring for new sites and prioritizing small infestations in otherwise
Perennial pepperweed			

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Lepidium latifolium (LELA2) Perennial with rhizome like creeping roots			healthy sites is important.. Next priority would be for corridors such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.

Direct and Indirect Effects

Direct effects occur at the same time and place as a FS action; indirect effects are effects associated with an action that occur at a place or time distant from the action. This analysis assumes that all potential effects from treatment (both herbicide and manual/mechanical methods) would originate when treatment occurs within 100 feet of aquatic habitat.

Table 6 below provides a summary of proposed treatment for known infestations by watershed (USGS 5th field HUC). Though it is recognized that newly discovered infestations may be treated within the analysis timeframe (15 years), it is likely that they will represent a minority addition to the known acres (2,124) proposed for treatment, and would not contribute a measurable change to effects estimates in the majority of watersheds; therefore, this analysis will focus on watersheds with known infestations, and will concentrate on those with the potential to produce measurable effects. Conservatively, and based on professional judgment, the potential for measurable effects to any aquatic species or their habitat would only occur at the watershed scale when greater than .5% (one half of one percent) of total available riparian area (within 100 feet of potentially occupied aquatic habitat) is proposed for treatment; this percentage was derived from habitat within national forest lands only. Greater than .5% near-stream treatment is proposed within the following six watersheds (Table 6): Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River. Within these specific watersheds, areas (e.g., 6th field watersheds, individual streams) of particularly concentrated treatment will be specifically addressed, since this is where there is the greatest potential for measurable effects.

Table 7: Proposed treatment near aquatic habitat

Watershed Name	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Upper Middle Fork John Day River	1707020301	94.21	**1.50**	BT, CH, ST, RT
Pine Creek	1705011603	31.01	1.45	RT
Big Creek	1707020303	49.8	1.04	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	.96	CH, ST, RT, WT
Camp Creek	1707020302	94.96	.69	BT, CH, ST, RT
North Basin	1712000101	15.97	.51	RT
Beech Creek	1707020109	21.43	.48	CH, ST, RT, WT

Watershed Name	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Upper Malheur River-Griffin Creek	1705011605	1.64	.43	RT
Upper South Fork John Day River	1707020101	18.20	.43	RT
Upper Silvies River	1712000201	19.63	.39	RT
Wolf Creek	1705011602	13.97	.33	RT
Little Malheur River	1705011612	4.88	.22	RT
Trout Creek	1712000203	19.86	.39	RT
Otis Creek	1705011606	2.15	.22	RT
Silvies Canyon	1712000205	4.97	.16	RT
Emigrant Creek	1712000206	9.79	.11	RT
Bear Creek	1712000202	1.47	.05	RT
Canyon Creek	1707020107	3.66	.05	CH, ST, RT, WT
Fields Creek	1707020111	1.52	.04	CH, ST, RT, WT
Cottonwood Creek	1707020209	3.84	.13	CH, ST, RT, WT
Upper Silver Creek	1712000403	.48	.02	RT
Upper North Fork Malheur River	1705011611	6.55	.10	BT, RT
Long Creek	1707020304	.64	.02	CH, ST, RT, WT
Upper John Day River	1707020106	4.69	.13	BT, CH, ST, RT, WT
Laycock Creek	1707020110	.87	.03	CH, ST, RT, WT
Lower North Fork John Day River	1707020210	.17	.00	CH, ST, RT, WT
Murderers Creek	1707020104	1.30	.02	CH, ST, RT, WT
Upper Malheur River	1705011601	6.50	.09	BT, RT
Strawberry Creek	1707020108	.44	.01	BT, CH, ST, RT, WT
Buck Creek	1707030303	0.00	0.00%	RT
Claw Creek	1712000402	0.00	0.00%	RT
Desolation Creek	1707020204	0.00	0.00%	RT
Granite Creek	1707020202	0.00	0.00%	RT
Grindstone Creek	1707030306	0.00	0.00%	RT
Headwaters Silver Creek	1712000401	.17	0.00%	RT
Lower South Fork John Day River	1707020105	0.00	0.00%	CH, ST, RT, WT
South Fork Beaver Creek	1707030307	0.00	0.00%	RT
Twelvemile Creek	1707030305	0.00	0.00%	RT
Willow Creek	1712000207	0.00	0.00%	RT
		Total: 462		

* Estimate of potential presence: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout

Project Design Features

The following aquatic-protecting project design features would reduce or prevent effects to aquatic species. The complete list (for all resources) is included in Appendix A.

Table 8: Aquatic-protecting project design features (see EIS for complete list)

PDF Reference	Design Features	Purpose of PDF	Source of PDF
B – Coordination with Other Landowners/Agencies			
B1	Coordinate treatments on neighboring lands and within municipal watersheds. For neighboring lands, base distances on invasive species reproductive characteristics, and current use.	To ensure that neighbors are fully informed about nearby herbicide use and to increase the effectiveness of treatments on multiple ownerships.	A variable distance based on site and species specific characteristics was chosen because it adjusts for various conditions that exist in these areas. All pdfs related to riparian areas and buffer distances will be followed.
C – To Prevent the Spread of Invasive Plants During Treatment Activities			
C1	Ensure vehicles and equipment (including personal protective clothing) does not transport invasive plant materials.	To prevent the spread of invasive plants during treatment activities	Common measure.
E – Non-herbicide Treatment Methods			
E1	Treatments implemented below the ordinary high water mark will be applied from the bank and workers will not walk in flowing streams regardless of treatment method.	To reduce the likelihood of causing negative impacts to fish and fish habitat.	Memorandum of Understanding between WDFW and USDA Forest Service, January 2005.
E2	Fueling of gas-powered equipment with tanks larger than 5 gallons would generally not occur within 150 feet of surface waters. Fueling of gas-powered machines with tanks smaller than 5 gallons may occur up to 25 feet of surface waters.	To protect riparian and aquatic habitats.	Common Measure
F – Herbicide Applications			
F1	Nonylphenol ethoxylate-based non-ionic (NPE) and ethoxylated fatty amine (POEA) surfactants would not be used. Vegetable oils/silicone blends that contain alkylphenol ethoxylate ingredients may be used.	To reduce risks associated with surfactants	SERA and Bakke risk assessments
F2	The least amount of a given herbicide would be applied as necessary to meet control objectives. In no case will imazapyr use exceed 0.70 lbs. a.i./ac. Broadcast application of Clopyralid, Glyphosate, Picloram, Sethoxydim, or Sulfometuron methyl will not exceed typical rates across any acre. Spot spray of triclopyr would not exceed typical rates across any acre.	To minimize herbicide exposures of concern to human health.	SERA and Bakke risk assessments
F3	Broadcast herbicide applications would occur when wind velocity is between two and eight	To ensure proper application of herbicide and reduce drift.	These restrictions are typical so that

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	miles per hour to reduce the chance of drift. During application, weather conditions would be monitored periodically by trained personnel.		herbicide use is avoided during inversions or windy conditions.
F4	To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles that minimize fine droplet spray, e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns.	To ensure proper application of herbicide and reduce drift.	These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see chapter 3 for details).
F5	No use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl and metsulfuron methyl) on dust-laden bare soils. Avoid bare areas >100 sq. ft. with powdery, ashy dry soil, or light sandy soil.	To avoid potential for herbicide drift.	Label advisory
F6	When herbicides are applied, a non-toxic blue dye will be used to mark treated areas.	To ensure treated areas are obvious to people and prevent accidental ingestion by plant collectors.	Common measure
G Herbicide Transportation and Handling Safety/Spill Prevention and Containment ▪ An *Herbicide Transportation and Handling Safety/Spill Response Plan* would be the responsibility of the herbicide applicator. At a minimum the plan would: ▪ Address spill prevention and containment. ▪ Limit quantity of herbicides to be transported to treatment sites to the amounts that are estimated to be needed for any given day. ▪ Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ▪ Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). ▪ Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ▪ Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ▪ Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. ▪ Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. ▪ Specify conditions under which guide vehicles would be required. ▪ Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters. ▪ Require that spray tanks be mixed or washed further		To reduce likelihood of spills and contain any spills.	FSH 2109.14

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	than 150 feet of surface water. ▪ Ensure safe disposal of herbicide containers. ▪ Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.		
H - Soils, Water and Aquatic Ecosystems			
H1	Follow herbicide-use buffers shown below. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.	To reduce likelihood that herbicides would enter surface waters in concentrations of concern and ensure that the project does not hamper attainment of riparian management objectives.	Herbicide-use buffers are based on label advisories; SERA risk assessments and Berg's 2004 study of broadcast drift and run off to streams. Herbicide-use buffers are intended to demonstrate compliance with R6 2005 ROD Standards 19 and 20.
H2	In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites, or for broadcast spraying will not travel off roadways, trails and parking areas if damage to riparian vegetation, soil and water quality, and aquatic habitat is likely.	To protect riparian and aquatic habitats.	Common protection measure
H3	Avoid using picloram and/or metsulfuron methyl on bare or compact soils, and inherently poor productivity soils that are highly disturbed. Poor soils include shallow soils less than 20 inch depth that lack topsoil and serpentine soils.	To preserve site recovery after disturbance, lessen offsite runoff and leaching. Poor soils will have longer residence times with these persistent herbicides.	Label advisory
H4	Do not use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application. Aminopyralid would not be broadcast in any are more than once per year.	Reduce potential for accumulation in soil.	SERA Risk Assessments. Based on quantitative estimate of risk from a maximum level of exposure.
H5	Limit herbicide offsite transport on sites with high runoff potential including sites with: shallow seasonal water tables, saturated soils (wet muck and peat soils), steep erosive slopes with shallow soils and rock outcrop, or bare compacted and disturbed soils. Limit runoff by applying herbicide during the dry season with the lowest soil moisture conditions, where > 50% groundcover exists on shallow slope sites, and > 70% on steep slope sites, and/or at reduced rates.	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.
H6	For soils with seasonally high water tables, do not use picloram or triclopyr BEE and limit glyphosate use to aquatic label only.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label advisory
H7	Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous	To reduce exposure to herbicides by providing some untreated areas for	SERA Risk Assessments. Based on quantitative

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.	organisms to use.	estimate of risk from maximum herbicide exposure scenario and uncertainty regarding effects to reptiles and amphibians.
H8	Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty in effects to some organisms, and label advisories.
H9	Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.	To reduce the potential for herbicide delivery to wells and springs that provide drinking water, and to protect watering systems used for grazing animals.	Label advisories and state drinking water regulations http://www.deq.state.or.us/wq/WhpGuide/ch2.htm.
H10	Use of Triclopyr BEE is only allowed in dry upland areas that are not hydrologically connected to water bodies.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label and quantitative assessment for risk to aquatic organisms.
H11	Do not spray when local weather forecast calls for a ≥ 50% chance of rain, or when wind speed at the site is in excess of 8 mph.	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.
J5	**Columbia Spotted Frog**		
J5-a	Avoid broadcast spraying of herbicides, or spot spraying of sulfometuron methyl within 100 feet of occupied or suitable spotted frog habitat. Follow herbicide-use buffers in wetlands. Treatment methods, timing and location will be coordinated with a local biologist prior to implementation.	Reduce impacts to the Columbia spotted frog.	Appendix P of the R6 2005 FEIS; SERA 2003, 2004; Bakke 2003
J10	**Harney Basin Duskysnail**		
J10-a	If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers.	Minimize likelihood that snails would be harmed from treatment	Malheur Invasive Plant BE

Table 9: Herbicide-use buffers (in feet) for streams, wetlands, lakes, ponds and roadside ditches with water present at the time of treatment. Measured in feet from the edge of surface water.

Herbicide	Streams, wetlands, lakes and ponds and hydrologically connected roadside ditches with surface water present	
	Broadcast	**Spot/Hand/Select**
Aquatic Glyphosate	50	Water's edge
Aquatic Imazapyr	50	Water's edge
Aquatic Triclopyr-TEA	Not Allowed	15
Aminopyralid	**Water's edge**	**Water's edge**
Clopyralid	100	15
Imazapic	100	15
Metsulfuron Methyl	**100**	**15**
Imazapyr	100	50
Sulfometuron Methyl	100	50
Chlorsulfuron	**100**	**50**
Picloram	100	50
Sethoxydim	100	50
Glyphosate	100	50

Table 10: Herbicide-use buffers (in feet) for stream channels that are dry at the time of treatment. Measured in feet from the edge of the channel as defined by the high water (bankfull) mark

Herbicide	Intermittent and Ephemeral Streams (Dry at time of treatment)	
	Broadcast	**Spot/Hand/Select**
Aquatic Glyphosate	Bankfull	No buffer
Aquatic Imazapyr	Bankfull	No buffer
Aquatic Triclopyr-TEA	Not Allowed	Bankfull
Aminopyralid	**No Buffer**	**No Buffer**
Imazapic	50	Bankfull
Metsulfuron Methyl	**50**	**Bankfull**
Clopyralid	50	Bankfull
Imazapyr	50	15
Sulfometuron Methyl	50	15
Chlorsulfuron	**50**	**15**
Picloram	100	50
Sethoxydim	100	50
Glyphosate	100	50
Triclopyr-BEE	Not Allowed	150

In addition to the above project design features and herbicide buffers, project "caps" have been established. These caps provide further sideboards to minimize adverse effects, including in cases where additional infestations are discovered, and ensure that the effects of treatments authorized under this EIS are consistent with the analysis disclosed in this EIS. Under alternative B:

- In no case would more than 2,124 discrete acres be treated using herbicides in a single year (based on our existing, site-specific inventory).
- No more than 30,000 acres (including initial and repeat treatments) would be treated using any method over the life of the project.
- No more than 10 percent of the total acres of any 6^{th} field subwatershed would be treated in a single year. No more than 50 total acres within 100 feet of all water bodies combined within any 6^{th} field watershed would be treated in a single year, with no more than 10 of the 50 acres being treated with herbicide.

Herbicide Effects – General

Terminology - the toxicology and risk assessment fields contain terms used to describe the technical information, which are not typically found in other technical fields. The following list of terms is included to assist the reader.

a.i. – active ingredient.
EEC- *Estimated/expected environmental concentration*: The estimated or expected herbicide concentration in an environmental media based on a particular set of assumptions and/or models.
HQ – *Hazard Quotient*: The ratio of the estimated level of exposure to a substance from a specific herbicide application to the reference dose for that substance, or to some other index of acceptable exposure or toxicity (e.g. 'toxicity index'). A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.
LOC – *Level of Concern*: The concentration in media or some other estimate of exposure above which there may be effects.
LOAEL or LOAEC – *Lowest-observed-adverse-effect level or lowest-observed-adverse-effect-concentration*: The lowest dose associated with an adverse effect.
NOAEL or NOAEC – *No-observed-adverse-effect level/concentration*: An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.
NOEL or NOEC - *No-observed-effect-level/concentration*: exposure level at which there are no statistically or biological significant differences in the frequency or severity of adverse effects between the exposed population and its appropriate control.
Toxicity index- The benchmark dose used in this analysis to determine a potential adverse effect when it is exceeded. Usually a NOAEL, but when data are lacking other values may be used.
LC50- LC stands for "Lethal Concentration". LC values usually refer to the concentration of a chemical in air but in environmental studies it can also mean the concentration of a chemical in water. This is the concentration of the chemical that kills 50% of the test animals within a given time.

The R6 FEIS Biological Assessment and SERA risk assessments address the effects of the proposed herbicides, inert ingredients, metabolites, and surfactants, to four aquatic species groups (fish, invertebrates, algae, and plants) in detail and this analysis is incorporated by reference. The SERA risk assessments used the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) chemical fate model and dilution calculations to estimate concentrations of herbicide in streams and ponds. GLEAMS is an edge-of-field and bottom-of-root-zone model that models pesticide movement within the field to which the pesticide is applied and estimates the amount of pesticide lost from the treated field via runoff, sediment, and percolation (SERA 2008). The SERA risk assessments are available via the internet at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml. The default parameters used in the SERA risk assessment modeling for fixed inputs include 10 percent for slope, rainfall timing of once every 10 days, a single soil layer (horizon), sparse grass for ground cover, 1.8 cfs for stream flow, and a 10 acre square for an application site. The input parameters selected for comparison are slope, soil types, rainfall, vegetation cover, and stream flow. Since the SERA risk assessments assumed no herbicide loss through breakdown, consideration of the influence of temperature to herbicide breakdown is not relevant.

The hypothetical application scenario analyzed in each SERA document involves the herbicide being applied along a 10-acre right-of-way that is 50 feet wide and 8,712 feet long. It is also assumed that a body of water runs along the length of the right-of-way and that the slope toward the water is 10 percent. Three types of soils are modeled: clay (high runoff potential), sand (low runoff potential), and loam (intermediate runoff potential). Annual rainfall rates range from 5 to 250 inches. Typical herbicide application rates are based on reported Forest Service use, while high application rates were either the highest application rate allowed under label restrictions or the highest application rate reported for Forest Service use. Potential effects from herbicides were analyzed separately for accidental spill, acute and chronic exposures. The accidental spill scenario has 200 gallons of the herbicide field dilution spilled directly into a 0.25 acre pond. A stream or water body contaminated by runoff and percolation immediately after application of an herbicide is the scenario used to predict acute exposure to aquatic species. The acute exposure scenario is associated with peak concentrations in water that might be expected after the application of an herbicide to a 10-acre block that is adjacent to and drains into a small stream or pond. Dissipation, degradation and other environmental processes are considered to predict chronic or longer-term exposure for aquatic species. The longer-term exposure scenario is based on average concentrations that might be expected after a similar application – i.e., a 10-acre block that is adjacent to and drains into a small stream or pond. The stream size used for the scenarios is at 1.8 cfs. The SERA risk assessments are designed to predict a “worst case scenario” of herbicide concentration.

The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are far less than levels of concern for fish, amphibians and aquatic invertebrates (EIS, chapter 3.5.3). Very little herbicide would reach water, even in an unbuffered scenario, because most of the herbicide is taken up in the plants and soil. Currently, fewer than 10 acres are infested within 100 feet of any stream in a 6th field watershed. However, a sample GLEAMS run was modeled using soil, slope, surface condition and weather information from the project area, assuming 10 acres are treated adjacent to the stream. This provides an indication of the maximum impact that could occur in alternatives B and D, given the elements of the project design that could be modeled. A second run was done to compare the results assuming a 100 foot no-herbicide buffer for Alternative C. SERA risk assessment worksheets provide Hazard Quotients (HQ), which is the EEC (estimated environmental concentration; i.e. concentration in water) of the herbicide divided by the most sensitive acute or chronic toxicity index available, such as no observable effect concentration (NOEC) or a fraction of an LC50. When 50% of the test organisms die, the test is stopped, and an LC50 (lethal concentration) or LD50 (lethal dose) is calculated. The smaller the amount of chemical required to kill 50% of the test organisms, the more toxic the chemical is. The NOEC values were designated as the concentration “level of concern” (LOC). Exceeding the LOC occurs when the HQ value exceeds 1. If a HQ value is less than or equal to one, then the estimated exposure is less than or equal to the toxicity index; this is presumed to indicate an acceptably low level of risk for that specific application. At this exposure, the risk of adverse effects to aquatic species is expected to be discountable.

The following table gives physical and chemical characteristics of the 11 herbicides being proposed for use. These characteristics are important in the following discussion of alternatives and analysis based on ground water transport model.

Table 11: Herbicide properties

Herbicide	Toxicity to Aquatic Organisms	Adsorption	Water Solubility (ppm)	Degradation Half-Life (days)		
				Soil Microbes	Water and Sunlight	Ground-water
Aminopyralid	low	low	205,000	14-343	0.6	127-447
Clopyralid	low	low	1,000	12-70	8-40	261
Chlorsulfuron	low	low	27,900	120-180	?	37-168
Glyphosate	moderate	strong	12,000	3-130	4-11	50-70
Imazapic	No info	moderate	>2670	25-142	1-2	30
Imazapyr	low	low	11-13,500	210-2154	500 stable in anaerobic conditions	N/A
Metsulfuron methyl	low	low	≈3,000-10,000 pH neutral	30-126	7-8	35 +
Picloram	low	low	200-400,000	18-300 in aerobic conditions; stable in anaerobic	2.6	14 aerobic; stable in anaerobic conditions
Sethoxydim	low	low	4700 @pH7	1-60 the high end of range is anaerobic conditions	5-43	155+@ pH7
Sulfometuron methyl	low	low	300 @ pH7	10-100	20-60	44-113
Triclopyr TEA	Inhibits fungal and bacterial growth	low	8,100	14-46	2-6 **hours**	6 **hours**
Triclopyr (BEE)	high	strong	2-23	0.2-40	0.5-8.7 Depending on pH	≈6

Table 12: Levels of concern for fish from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
Aminopyralid	Acute	NOEC	50mg/l	Rainbow Trout	None available
	Chronic	NOEC	1.35 mg/l	Rainbow Trout	None available

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
	Chronic	NOEC[1]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	0.5 mg/L (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	0.065 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonids	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	100 mg/L	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	"nearly significant" effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weight and length of fry reduced at 0.88 mg/L
Sethoxydim	Acute	NOEC	0.06 mg/L (1/20th LC50)	Rainbow trout	LC50 of Poast at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	1.17 mg/L	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[3]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute		0.012 mg/L	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic[4]	NOEC	104 mg/L	Fathead	Reduced survival of

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
				minnow	embryo/larval stages at 140 mg/L

*--NOEC = No Observed Effect Concentration

**--LC50, Lethal Concentration, 50% kill

***--LOAEL—Lowest Observed Adverse Effect Level

Table 13 : Levels of concern for aquatic invertebrates from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Toxicity Indices: AQUATIC INVERTEBRATES Indices represent most sensitive endpoint for most sensitive species for which adequate data are available.				
Herbicide	**Duration**	**Concentration**	**Species**	**Effects noted at LOAEL**
Aminopyralid	Acute	98mg/L	Daphnia magna	No effects observed
	chronic	102 mg/L	Daphnia magna	No effects observed
Chlorsulfuron	Acute	10 mg/L	daphnid	Mortality
	chronic	20 mg/L	daphnid	Mortality
Clopyralid	Acute	214 mg/L	daphnid	Mortality
	chronic	11.8 mg/L	daphnid	Mortality
Glyphosate (most toxic formulation)	Acute	11 mg/L	Daphnia magna	Mortality
	chronic	0.7 mg/L	Daphnia magna	Estimated from less toxic formulation
Imazapic	Acute	100 mg/L	Daphnia magna	No effect at any concentration
	chronic	100 mg/L	Daphnia magna	No effect at any concentration
Imazapyr	Acute	100 mg/L	Daphnia magna	No effects observed
	chronic	97.1 mg/L	Daphnia magna	No effects observed
Metsulfuron Methyl	Acute	420 mg/L	Daphnia magna	Immobility
	chronic	17 mg/L	Daphnia magna	Growth
Picloram	Acute	26.8 mg/L	Shrimp	Mortality
	chronic	3.8 mg/L	Oyster larvae	Mortality
Sulfometuron Methyl	Acute	75 mg/L	Alonella spp. & Cypria spp.	Not given
	chronic	0.19 mg/L	Alonella spp. & Cypria spp.	Neonate survival
Triclopyr TEA	Acute	133 mg/L	Not given	Mortality
	chronic	81 mg/L	daphnid	Reproduction

Table 14 : Levels of concern for algae from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Toxicity Indices: ALGAE Indices represent most sensitive endpoint for most sensitive species for which adequate data are available.				
Herbicide	**Duration**	**Concentration**	**Species**	**Effects noted at LOAEL**
Aminopyralid	acute chronic	6 mg/L	Diatoms	Cell density
Chlorsulfuron	acute chronic	0.01 mg/L	Selanastrum capriconutum	Mortality
Clopyralid	acute	6.9 mg/L	Selanastrum capriconutum	Growth inhibition

	chronic	Chronic study of duckweed showed EC50 >> sensitive algae (acute)		
Glyphosate (most toxic formulation)	Glyphosate appears to be about equally toxic to algae and aquatic plants; see aquatic plants table			
Imazapic	acute chronic	0.05 mg/L ***	Various species	Growth inhibition
Imazapyr	acute chronic	0.2 mg/L *	Chlorella	Growth inhibition
Metsulfuron Methyl	acute	0.09 mg/L	Selanastrum capriconutum	Growth inhibition
	chronic			Only short-term data available
Picloram	acute chronic	0.23 mg/L 0.23 mg/L	Diatoms	Growth inhibition
Sulfometuron Methyl	acute chronic	0.0025 mg/L	Selanastrum capriconutum	Cell density
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

Table 15 : Levels of concern for aquatic plants from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Toxicity Indices: AQUATIC PLANTS **Indices represent most sensitive endpoint for most sensitive species for which adequate data are available.**				
Herbicide	**Duration**	**Concentration**	**Species**	**Effects noted at LOAEL**
Aminopyralid	acute chronic	44mg/L	Duckweed	Frond Density
Chlorsulfuron	acute chronic	0.00047 mg/L *	Lemna minor	Mortality
Clopyralid	See information for algae			
Glyphosate (most toxic formulation)	acute chronic	3 mg/L	Duckweed	Growth inhibition
Imazapic	acute chronic	0.0013 mg/L	Lemna gibba	Growth inhibition
Imazapyr	acute chronic	0.013 mg/L **	Lemna gibba	Growth inhibition
Metsulfuron Methyl	acute	0.00016 mg/L	Duckweed	Based on chronic data
	chronic			Mortality
Picloram	acute chronic	0.1 mg/L ***	Water milfoil	Transient inhibition of flowering
Sulfometuron Methyl	All	0.00021 mg/L	Lemna gibba	Mortality

Toxicity Indices: AQUATIC PLANTS **Indices represent most sensitive endpoint for most sensitive species for which adequate data are available.**				
	exposures			
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

Indirect effects of chemicals used to treat invasive plants on ecosystem structure and function are important in determining overall risk to aquatic organisms (Preston 2002). Algae and aquatic plants are generally more sensitive than aquatic animals to effects from herbicides. Therefore, herbicides can affect the structure of aquatic communities at concentrations below thresholds for fish and aquatic invertebrates. Model runs indicate that thresholds for algae would not be approached in any treatment sites. For plants (*Lemna gibba*), models indicate that an exposure threshold could be approached (slightly below) for the herbicide sulfometuron methyl. Any potential effects to this aquatic plant community would be spatially isolated, representing much less than one percent of total aquatic habitat. Therefore, indirect effects (e.g., change to growth rates of macroinvertebrate prey organisms) to aquatic species of conservation concern, resulting from isolated potential aquatic plant impacts, are unlikely to be detectable.

Indirect effects from herbicide and non-herbicide treatment methods are possible if bare soil exists following treatment, due to the potential for erosion and sediment delivery to streams, primarily in the time period between application and native plant regrowth, when soil may be slightly destabilized. Vegetation reduction in near-stream areas could slightly alter the food base for fish by changing habitat for terrestrial invertebrates; this potential effect would be short term and affect a small minority of total terrestrial habitat.

Project design features and annual and life of the project “caps” would be implemented to minimize or eliminate adverse effects at any scale, even assuming the maximum possible treatment that could occur. Effects capable of reaching an adverse level for federally listed fish would be related to short-term (a few years post-treatment) increases in sediment and turbidity; both herbicide and non-herbicide treatment methods could destabilize near-stream soils, though non-herbicide methods (e.g., pulling) generally pose a greater risk due to increased soil disturbance. Watershed-based results were extrapolated to the western ridged mussel through the assumption that this sympatric species shares most habitat requirements with native fish, and results are logically transferable. Assuming that near-stream native vegetation is beneficial to aquatic habitat, the long-term result of this project for all aquatic species would be positive as invasive plants are replaced by native species. This change would presumably occur within a few years post-treatment in most cases.

Results of GLEAMS for selected sites within the project area are shown in the tables below. Three of the four sites were adjacent to streams with flow rates varying by an order of magnitude. Two of the streams (Granite Boulder and Clear Creeks) are mapped as bull trout spawning and rearing reaches, and provide a meaningful example of “higher-concentration treatment scenario” for federally listed aquatic analysis species.

Results of GLEAMS runs are shown for four selected sites in the tables below. Three of the sites were adjacent to streams with flow rates varying by an order of magnitude. Two of the steams are mapped as bull trout spawning and rearing reaches. Sites 1, 2 and 4 are centered on a native surface road. Site 3 does not have a road running through the treated area, but the area is adjacent to a stream. Sites 1 and 4 are buffered from the streams by natural forested slope in excess of the herbicide use buffers. The water concentration values reported assume an average width of the untreated slope between the stream and treated area.

In Site 2, the road crosses the stream and therefore there is the possibility of runoff from the road surface, and the treated area adjacent to the road surface, entering directly into the stream. Project design features would be applied to roads the same as other treated areas of the forest. For example road cuts may intercept groundwater flow and are classified as seeps. Forest soils besides roads may also be areas of seasonably high water table and therefore are treated like any other area of the forest.

In all model runs, the maximum application rate was used to calculate concentrations in the soil and in a non-treated area below the treatment site. The GLEAMS model does not explicitly incorporate distance from a stream, however the amount of herbicide predicted to be delivered to a non-treated area below a treated area is provided. This amount can then be run to predict the amount of herbicide that could eventually reach the stream. One application of chemicals was assumed per year. For reported concentrations, 0.001 Mg/l is approximately 1 ppb.

Site #1 (Ennis Creek) was modeled assuming a worst case scenario for alternative B. The Ennis Creek site is along road 4110. It has moderately deep, gravelly clay soils. The modeled run assumed 10 acres are treated to the edge of this 2 cfs stream. The infested area is approximately 3 acres, however the acreage was increased in order to model the maximum amount of herbicide that might reach the stream given the EDRR cap of 10 riparian treatment acres within a 6th field watershed. The model run assumed that 100 percent of the 10 acres are treated using the maximum allowable herbicide use rate. This run does not consider broadcast rate restrictions associated with clopyralid, glyphosate, picloram, sethoxydim, or sulfometuron methyl or the spot treatment rate restriction for triclopyr. The model does not differentiate between application methods so the maximum rates allowed for any method were assumed. Triclopyr TEA is the formulation used in the model. Triclopyr BEE would only be used in upland sites far from water.

Results of GLEAMS runs are shown in the following tables for selected sites. We modeled the results of using any of the 11 herbicides at these sites, however, only the first-choice herbicide and other effective herbicides described in table 8 would likely be used, unless a new target species were to occupy these sites and need treatment under our EDRR proposal.

Table 16. GLEAMS Result, Worst Case Scenario, Site 1

Herbicide	App'l Rate (lbs/acre a.i.)	Conc. At 12" (Mg/l)	Conc. At 36" (Mg/l)	Water Peak Conc.' (Mg/l)
Aminopyralid	0.11	0.0192	0.0	0.0000
Chlorsulfuron	0.13	0.0432	0.0	0.0007
Clopyralid	0.5	0.0983	0.0	0.0001
Glyphosate	3.5	0.6283	0.0	0.0000
Imazapic	0.19	0.0566	0.0	0.0014
Imazapyr	0.70	0.1644	0.0	0.0019
Metsulfuron Methyl	0.075	0.0240	0.0	0.0030
Picloram	1.00	0.2911	0.0	0.0040
Sethoxydim	0.47	0.0891	0.0	0.0009
Sulfumeturon methyl	0.38	0.0712	0.0	0.0002

Herbicide	App'l Rate (lbs/acre a.i.)	Conc. At 12" (Mg/l)	Conc. At 36" (Mg/l)	Water Peak Conc.' (Mg/l)
Triclopyr TEA	6.00	1.3363	0.0	0.0045

For Sites 2-4, the actual location and size of the treatment site was modeled.

Table x. GLEAMS model runs results. All values in mg/l (ppm). .

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12")	Conc. In Soil (36")	Peak Conc. In Water**
Site# 2 Invasive: Canada thistle First Choice: Aminopyralid Location: T10S R34E S35 Road: Maintenance Level 2 Road #7106 HUC6: Camp Creek Stream name: unnamed Model Run design flow 2cfs	Five Beaver soil series gravelly silt loam/extremely cobble silt loam, shallow depth, 14 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1800 feet long 50 feet wide centered on road, 350 to 700 feet from stream. Hill slope gradient 27%	aminopyralid	0.0334	0.0000	0.0002
			chlorsulfuron	0.0311	0.0000	0.0001
			clopyralid	0.1055	0.0000	0.0002
			glyphosate	0.6486	0.0000	0.0001
			imazapic	0.0582	0.0000	0.0003
			imazapyr	0.0227	0.0000	0.0001
			metsulfuron methyl	0.0248	0.0000	0.0001
			picloram	0.3030	0.0000	0.0012
			sethoxydim	0.0919	0.0000	0.0002
			sulfometuron methyl	0.0807	0.0000	0.0003
			triclopyr TEA	1.3705	0.0000	0.0009
Site#3 Invasive: St. Johnswort First choice: aminopyralid Location: T10S R34E S32, HUC6: Camp Creek Stream name: Granite Boulder Creek, bull trout spawning/rearing Model Run design flow 10cfs	Melloe soil series Loam/very cobble sandy clay loam, very deep, 79 inches	Conifer forest, excellent grass, moderate runoff potential Treatment area: 350 feet X 500 feet along Granite Boulder Creek and below Road 4611 Hill slope 3%	aminopyralid	0.0268	0.0115	0.0000
			chlorsulfuron	0.0302	0.0101	0.0000
			clopyralid	0.1	0	0.0000
			glyphosate	0.6282	0.0348	0.0000
			imazapic	0.0570	0.190	0.0001
			imazapyr	0.2086	0.0697	0.0002
			metsulfuron methyl	0.219	0.0076	0.0000
			picloram	0.2809	0.0992	0.0002
			sethoxydim	0.0892	0.0297	0.0000

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12")	Conc. In Soil (36")	Peak Conc. In Water**
			sulfometuron methyl	0.0785	0.0262	0.0001
			triclopyr TEA	1.3358	0.4453	0.0001
Site#4 Invasive: houndstongue First choice: chlorsulfuron Location: T11S R35E S34, Road: maintenance Level 2 Road # 2255 HUC6: Clear Creek Stream name: Clear Creek/bull trout spawning—rearing Model Run design flow 2cfs	Wonder soil series, Gravelly silt loam/gravelly loam, very deep, 79 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1,180 feet long and 50 feet wide centered on road, 180 to 250 feet from stream	aminopyralid	0.0216	0.0103	0.0003
			chlorsulfuron	0.0310	0.0104	0.0001
			clopyralid	0.054	0.0356	0.0001
			glyphosate	036484	0.2161	0.0000
			imazapic	0.0577	0.0192	0.0003
			imazapyr	0.2117	0.0706	0.0008
			metsulfuron methyl	0.0246	0.0082	0.0001
			picloram	0.2895	0.00976	0.0001
			sethoxydim	0.0982	0.0306	0.0002
			sulfometuron methyl	0.1126	0.0375	0.0002
			triclopyr TEA	1.3707	0.4659	0.0010

Results for all herbicides are below the threshold of concern for fish, algae, and invertebrates (see Chapter 3.6 for more information). Results for metsulfuron methyl are above the threshold of concern and chlorsulfuron, and sulfometuron methyl are slightly above or at the threshold for concern for aquatic plants. Individual aquatic plants could be adversely affected but the extent would be limited to a small area and would not be large enough to affect habitat or the aquatic food chain. Considering project PDFs, buffers, and caps, the actual concentration of herbicide is likely to be lower than modeled values; therefore, the potential for spatially isolated low-magnitude effects to aquatic plants is unlikely to result in measurable effects to fish.

This analysis recognizes that there is some risk of new infestations over the life of the project (15 years) within both currently infested or currently un-infested watersheds that could be treated, with a corresponding chance of measurable effects. Previously discussed project design features and treatment caps would considerably reduce or prevent effects. Since modeling runs assumed maximum herbicide treatment levels, the magnitude of any herbicide-related effects within future sites would not be expected to exceed those modeled for current sites.

<u>Non-Herbicide Treatment</u>

Multiple methods may be used singularly or in combination with herbicides to accomplish project objectives. Specific manual, mechanical, biological, herbicide, and cultural/restoration treatments would be determined at time of treatment.

Considering the low percentage (watershed-based) of proposed treatment, the primary non-chemical effect of concern is increased sediment production. Any treatment method that removes or kills near-stream vegetation is capable of producing sediment effects, both at time of treatment (e.g., grubbing/pulling), and/or indirect effects later in time such as during storm events. In addition, ground disturbance may also occur within some riparian areas due to all-terrain vehicle use; this effect is expected to be minimal since most sites are located immediately adjacent to existing roads, limiting the need for substantial off-road travel. Due to numerous aquatic-related project design features and total treatment "caps", meaningful differences in realized effects due to specific treatment type are unlikely. The watershed-based effects section below assumes that any combination of treatment types may be used at each infestation site, and that they all provide some risk of increased sediment mobilization; the relative magnitude of this risk is based on quantity of near-stream proposed treatment. The maximum potential treatment scenario, and associated effects, would be limited by the project caps that limit treatment to 10% of a 6^{th} field watershed, and no more than 50 acres of total treatment within 100 feet of water bodies. Even under a maximum manual treatment scenario, ground disturbance would only be expected to produce a few pounds of sediment production per acre (project hydrology report).

Idaho Creek-Summit Creek HUC6 was modeled for sediment production from manual treatment because it currently has the largest concentration, of mapped invasive plants at that watershed level within 100 feet of a mapped stream; a total of 51.29 acres. Also within the Idaho-Summit Creeks watershed is 10.9 miles of forest roads within 100 feet of a mapped stream, or approximately 18.5 acres of running surface which equals 37 tons of sediment per year versus 0.06 tons from manual treatment. The road surfaces are contributing sediment every year though rates will vary widely according to slope and drainage.

Effects by Watershed and Species

As stated previously, there are six currently infested watersheds where treatment could conceivably produce detectable effects, as defined by greater than 0.5% of total near-stream (100ft) habitat within national forest lands proposed for treatment (Figure 1).

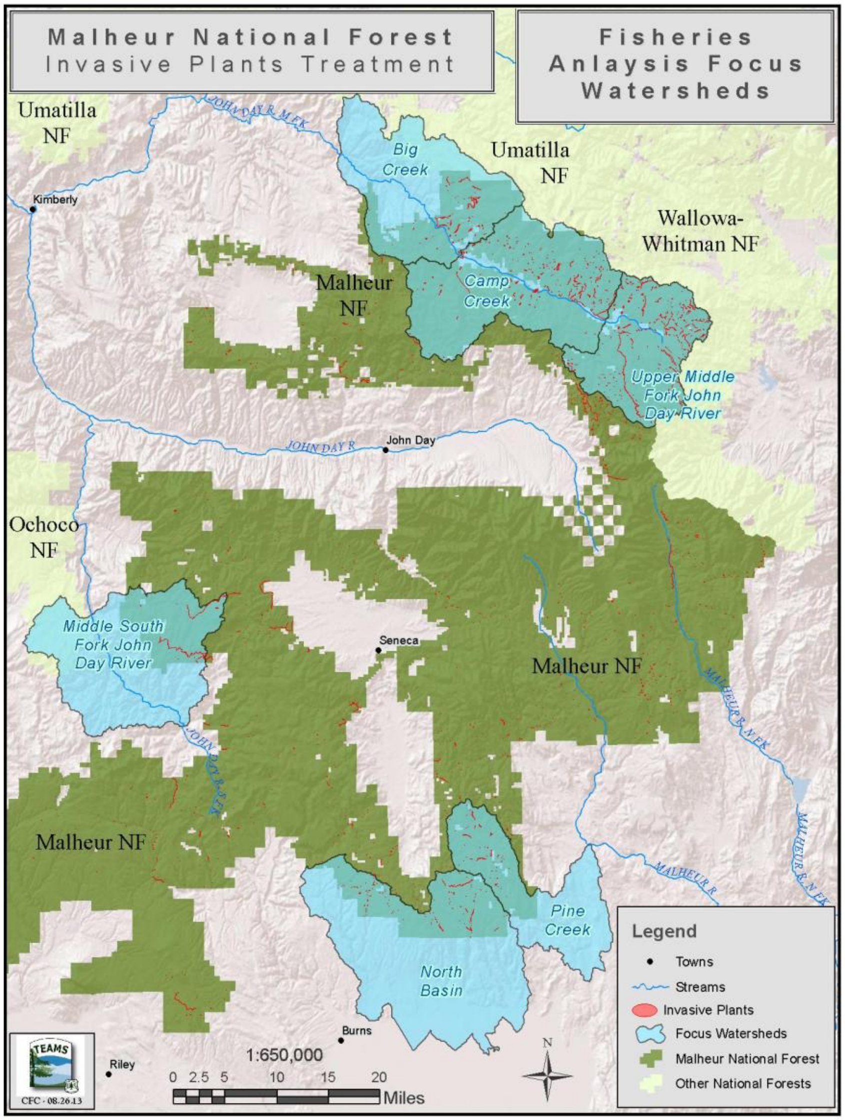

Figure 1: Focus watersheds for fisheries analysis

Table 17: Watersheds with known infestations and with potential detectable effects

Watershed Name (alphabetical order)	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Big Creek (Middle Fork John Day River)	1707020303	49.80	**1.04%**	BT, CH, ST, RT
Camp Creek (Middle Fork John Day River)	1707020302	94.96	**.69%**	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	**.96%**	CH, ST, RT, WT
North Basin (Malheur River)	1712000101	15.97	**.51%**	RT
Pine Creek	1705011603	31.01	**1.45%**	RT
Upper Middle Fork John Day River	1707020301	94.21	**1.50%**	BT, CH, ST, RT

* Estimate of potential presence: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout

Big Creek Watershed

Approximately 49.80 acres (1.04%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Elk Creek, Deep Creek, Mosquito Creek, Deadwood Creek, and Swamp Gulch. The areas of highest relative risk for measurable sediment effects are along Deep Creek and Mosquito Creek, where, respectively, approximately 1 mile (16 acres) and ½-mile (5-8 acres) of treatment are proposed. The remainder of the units are small and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. These segments represent less than 10 percent of stream length within the sub-watershed; therefore any effects would be low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed

Camp Creek Watershed

Approximately 94.96 acres (.69%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout, and aquatic invertebrates. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Infestations are widely distributed throughout this watershed, both along critical habitat and in tributary reaches. Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Camp Creek, Cottonwood Creek, Lick Creek, Myrtle Creek, Big Boulder Creek, Badger Creek, Dry Creek, Beaver Creek, Ragged Creek, Butte Creek, Little Boulder Creek, Windlass Creek, Tincup Creek, Granite Boulder Creek, Vincent Creek, Vinegar Creek, Davis Creek, Placer Gulch, Middle Fork John Day River, Blue Gulch, Lemon Creek. The areas of highest relative risk for measurable sediment effects are along Caribou Creek and Little Boulder Creek, where approximately ½-mile of treatment would occur along each stream. The remainder of units are small (less than ¼-mile along stream) and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. In total, segments proposed for treatment represent less than 10 percent of stream length within any sub-watershed; therefore any effects would be low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed

Middle South Fork John Day River

Approximately 27.62 acres (.96%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for steelhead and essential fish habitat for Chinook salmon. Habitat exists for redband trout and westslope cutthroat trout.

Most of the treatment proposed in this watershed is along Deer Creek and North Fork Deer Creek, both of which are designated critical habitat. Potential sediment/turbidity effects to fishes include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. More than a mile of treatment could occur along these two streams. Project “caps” would limit total annual treatment to 10% of the 6th field watershed (Corral Creek) where a relatively high concentration of sites exists. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed. Because more treatment could be concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas (low-moderate), however duration would be short term.

North Basin

Approximately 15.97 acres (.51%) of near-stream treatment is proposed on National Forest System land within this watershed.

There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Polson Creek, Devine Canyon, Armstrong Canyon, Cow Creek, Rattlesnake Creek, East Fork Rattlesnake Creek, West Fork Rattlesnake Creek, and Middle Fork Rattlesnake Creek. A few sites within the Rattlesnake Creek drainage are approximately ½-mile in length; these sites pose the greatest risk of potentially measurable sediment/turbidity effects. Because less than 10 percent of this sub-watershed would be treated, and no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed, any effects that could occur would be of low magnitude and short term.

Pine Creek

Approximately 31.01 acres (1.45%) of near-stream treatment is proposed on National Forest System land within this watershed.

There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Pine Creek and unnamed tributaries, West Fork Pine Creek, and Alkali Creek and unnamed tributary. One site along an unnamed tributary in the headwaters of Pine Creek, and a site along West Fork Pine Creek, each exceed ½-mile in length. These areas pose the greatest risk of producing measurable sediment/turbidity effects. Potential sediment/turbidity effects to fishes include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. Because less than 10 percent of this sub-watershed would be treated, and no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed, any effects that could occur would be of low magnitude and short term.

Upper Middle Fork John Day River

Approximately 94.21 acres (1.50%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Bridge Creek, Clear Creek, Dry Fork Clear Creek, Mill Creek, Crawford Creek, Summit Creek, Idaho Creek, and Squaw Creek. The area of highest relative risk for measurable sediment effects is along Crawford Creek, where more than a mile of treatment along the stream is proposed. Project "caps" would limit total annual treatment to 10 percent of the 6th field watershed (Mill Creek) where this relatively high concentration of sites exists. In addition, no more than 50 acres (of which 10 acres may include herbicide) of treatment would occur per year within 100 feet of streams in this sub-watershed. Because there would be more treatment concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas (low-moderate), however duration would be short term.

Effects on Habitat Indicators

The proposed action would have minimal effects on habitat for aquatic organisms, including species of conservation concern. Several overlapping types of analysis are done for aquatic organisms, mainly focused on species of conservation concern. The following is an analysis of the effects on *Steelhead Primary Constituent Elements* (PCE) for designated critical habitat as determined via analysis of "*Matrix of Pathways and Indicators*" (MPI) analysis. This analysis also covers the *Essential Habitat Features* of Chinook salmon designated critical habitat. The PCE/MPI discussion about potential impacts on temperature, sediment, large woody debris, pool frequency and quality, wetted width/maximum depth ratio, and streambank condition are specifically relevant to findings about PACFISH/INFISH consistency.

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The following analysis results are largely dependent upon project design features and project caps that were developed to minimize or prevent a wide range of effect types. A selection of those particularly important to chemical contamination and sediment habitat indicators includes the following:

- Variable width herbicide-use buffers for all herbicides based on aquatic risk (**Error! Reference source not found.** and **Error! Reference source not found.**).
- No more than 10 percent of the total acres of any 6^{th} field subwatershed, and no more than 50 acres within 100 feet of any water body in a 6^{th} field watershed would be treated in a single year, with no more than 10 of the 50 acres being treated with herbicide.
- In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites or for broadcast spraying will not travel off roadways, trails and parking areas.

For the complete list of project design features see **Error! Reference source not found.**.

PCE Crosswalk – Bull Trout

A crosswalk between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Critical Habitat. The Matrix of Pathway Indicators (MPI) for bull trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of bull trout.

The MPI analysis incorporates 4 population indicators and 19 physical habitat indicators. Analysis of the habitat indicators can provide a thorough evaluation of the existing baseline condition and potential project impacts to the PCEs of critical habitat for bull trout. **Error! Reference source not found.** shows the relationship between the PCEs for bull trout critical habitat and the MPI habitat indicators.

The limited ground disturbance and absence of in-stream treatment would limit potential effects to the following habitat indicators: temperature, sediment, chemical contaminants/nutrients, large woody debris, pool frequency and quality, and riparian conservation areas. The majority of these effects would be of very low magnitude, and undetectable in most areas. Treated riparian area vegetation would likely experience rapid regrowth, and the majority of near-stream vegetation would not be treated. Stream reaches where treatment is concentrated could experience measurable levels of sediment/turbidity increase post-project during storm events, but these effects would be spatially restricted, short-term, and low-magnitude. PCEs potentially affected (most undetectable) include: 1, 2, 3, 4, 5, 6, 7, and 8.

Table 18. Bull trout PCEs and MPI habitat indicators

	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
Diagnostic Pathway Indicator	**Springs, seeps, groundwater**	**Migratory Habitats**	**Abundant food base**	**Complex habitats**	**Water Temperature**	**Substrate Features**	**Natural Hydrograph**	**Water quality and quantity**	**Predators competition**
Water Quality									
Temperature		x	x		x			x	
Sediment		x	x			x		x	
Chemical contaminants nutrients	x	x	x					x	
Habitat Access									
Physical Barriers	x	x	x						x
Habitat Elements									
Substrate Embeddedness	x		x			x			
Large Woody Debris				x		x			
Pool Frequency and Quality			x	x		x			
Large Pools				x	x				
Off-Channel Habitat				x	x				
Refugia		x			x				x
Channel Conditions and Dynamics									
Wetted Width/Maximum Depth Ratio		x		x	x				
Streambank Condition	x			x	x	x			
Floodplain Connectivity	x		x	x	x		x	x	
Flow/Hydrology									
Changes in Peak/Base Flows	x	x			x		x	x	
Drainage Network Increase	x						x	x	
Watershed Conditions									
Road Density and Location	x				x		x		
Disturbance History				x			x	x	x
Riparian Conservation Areas	x		x	x	x		x		
Disturbance Regime				x			x	x	

Pathway: Water Quality

Indicator: Temperature, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

Stream temperature is controlled by many variables at each site. These include topographic shading, stream orientation, channel morphology, discharge, air temperature, and interactions with ground water, which would not be measurably influenced by invasive plant treatments in the vast majority of treatment locations. In a few areas, treatment of invasive plants would change understory and ground vegetation, and would be limited in quantity by project design features and project "caps," the majority of shade-providing vegetation is expected to be retained. This small percentage near-stream areas needing treatment would not be capable of changing solar radiation to a degree that would measurably affect stream temperature. Therefore, direct or indirect effects on the temperature indicator would not affect spawning, rearing, or migration PCEs.

Pathway: Water Quality

Indicator: Chemical Contaminants/Nutrients, PCE Crosswalk: Spawning habitat PCEs

The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches. Other concerns such as drift, overspray, and spills are addressed through project design features were designed to control drift and overspray.

GLEAMS model results (**Error! Reference source not found.**, chapter 3.5.3) indicate that no chemical water concentrations would approach levels of concern for any aquatic species, therefore direct effects from chemical contamination are expected to be negligible in all project watersheds. Indirect effects resulting from spatially isolated potential effects to non-analysis taxa (e.g., algae/aquatic plants) would be spatially isolated and temporary.

The potential risk from accidental spills in RHCAs exists; however, PDF G describes mechanism to minimize the occurrence and restrict highly concentrated chemicals proximity to water.

In summary, alternative B is not likely to adversely affect water quality or result in water contamination that could adversely affect fish.

Pathway: Channel Condition & Dynamics

Indicator: Floodplain Connectivity, PCE Crosswalk: Rearing habitat PCE

Some invasive plant treatments can have long-term positive effects on floodplains and streambanks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach on floodplains where road-related, grazing, or recreational activities have led to the establishment of invasive plant populations. Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long-term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia. Potential localized, short-term, and low-magnitude sediment/turbidity increases would not be sufficient to alter channel condition and dynamics. Therefore, alternative B is unlikely to affect floodplain connectivity or fish rearing habitat.

Pathway: Habitat Access

Indicator: Physical Barriers, PCE Crosswalk: Migration habitat PCE

Invasive plant treatments would not create physical barriers or otherwise degrade access to aquatic habitat since there is no causal mechanism from proposed activities. Habitat access, physical barriers and migration habitat would not be affected by alternative B.

Pathway: Habitat Elements

Indicator: Substrate/Sediment, PCE Crosswalk: Spawning, Rearing habitat PCEs

Herbicide treatment methods that would be utilized within the riparian areas include spot- spray and hand applications. These treatment types are unlikely to produce measurable sediment in the majority of locations because very little ground disturbance would take place, though very minor inputs could conceivably occur during the period of time between plant death and regrowth. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable in most areas. In the few areas where more intense treatment could occur, disturbance areas would be limited in quantity by herbicide use buffers, project design features and project “caps”.

Sediment increases would be limited to short-term (e.g., a few hours/days) inputs during, and immediately following, intense precipitation events. A small increase in turbidity is the most likely effect and minor increases in surface fines could occur in some pool habitat. The substrate/sediment indicator would not be measurably affected over the long-term because treatment of invasive plants would not result in a chronic sediment source; less disturbance would occur during retreatment because populations would decrease each treatment entry (see 3.1.4 for more information on treatment effectiveness). Sediment could affect spawning and rearing PCEs over the short-term within a small minority of available habitat; however no measurable change is expected long-term.

Indicator: Large Woody Debris, and Pool Area, Quality and Frequency, PCE Crosswalk: Spawning habitat PCE

Treatment of invasive plants would not impact pool area, quality, and frequency as a causal mechanism does not exist.

Near-stream treatment of invasive plants would not impact current wood debris in streams. As the vast majority of native vegetation would be retained in all treatment sites, it is highly unlikely that future woody debris recruitment would be affected. Therefore, spawning habitat would not be affected by changes to the large woody debris, and pool area, quality and frequency indicators

Pathway: Flow/Hydrology

Indicator: Change in Peak/Base Flows, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

A small percentage of each watershed (even small subwatershed) would be treated during a single year; in most cases it would be less than one percent. Project “caps” establish an absolute maximum of 10 percent of any 6th field watershed per year, but this is highly unlikely to occur given that the current level of infestation is far lower. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any sub-watershed. The treatments will not affect stream flow or fish migration habitat.

Effects at the 5th field Watershed Scale

Several 5th field watersheds have scattered infestations within 100 feet of aquatic habitat (**Error! Reference source not found.**). The focus of the effects analysis for aquatic organisms is on the eight 5th-field watersheds where more than one-half of 1 percent of the area within 100 feet of streams or other water bodies is infested. [2] These include: Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River (**Error! Reference source not found.**).

Land and Resource Management Plan Amendment

The effects of adding aminopyralid to the list of available herbicides would not adversely affect fish. The Environmental Protection Agency classified aminopyralid as a "reduced risk" herbicide and stated that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species [including fish] (U.S. EPA 2005 *in* SERA 2007 Risk Assessment).

Early Detection and Rapid Response

The early detection and rapid response component of the project would have similar impacts to treatment of known sites due to the implementation planning process that would ensure new detections are treated according to PDFs, treatment caps and herbicide use buffers. The greatest potential impact would be localized sediment/turbidity of low magnitude as discussed above for areas that currently have the highest concentration of invasive plants in a subwatershed.

Cumulative Effects of All Action Alternatives

The baseline for cumulative effects analysis is the current condition as described in the affected environment section above. The differences between alternatives in terms of impacts to fisheries are so small that cumulative effects would be the same across alternatives.

Current and reasonably foreseeable actions on National Forest System lands are listed in chapter 3.1.5. Actions that could add to effects within specific watersheds where measureable project-related effects (e.g., sediment production) are deemed possible will be addressed qualitatively within the analysis below. For the remaining watersheds, where project effects are deemed absent or "discountable", there would be no meaningful additions to the combined effects from other actions in the absence of newly discovered and treated infestations.

<u>Herbicide Application</u>

Herbicides are commonly applied for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Studies (see chapter 3.1.5) have shown that pesticides are commonly found in surface waters in Oregon and throughout the United States. However, the studies indicate that herbicide use similar to the type proposed in this project would not result in harmful concentrations of herbicide in water. These potential additions will be analyzed qualitatively based on percentage of non-national forest lands present within specific watersheds where effects are potentially measurable. Herbicide

[2] Treatment of scattered infestations that occupy less than one-half of one percent of the riparian area in a 5th-field watershed are unlikely to have any detectable effects to fish or other aquatic organisms (professional judgment, Mease 2013). This is a very conservative level, far below the treatment limits associated with the PDFs and annual and life of the project caps.

concentrations from the project are expected to be undetectable or very low in all waterways, and would therefore add little or nothing to herbicide-related cumulative effects.

The effect of higher than historic water temperature on sensitivity of fish to proposed herbicides is unknown. The exposure scenarios likely overestimate the amount of herbicide that may reach streams because they do not account for all aspects of project design that minimize the potential for herbicide to reach water bodies. In addition, the thresholds of concern for fish are conservative; the exposure scenarios and thresholds of concern likely account for any potential increased sensitivity due to water temperature. Therefore, the project is not expected to add to potential temperature-related effects from other ongoing or foreseeable projects.

Sediment/Turbidity

Sediment production from project actions could add to sources derived from other actions on National Forest System lands, tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. These potential additions will be analyzed qualitatively based on percentage of lands of other ownership present within specific watersheds where effects are potentially measurable. Project caps would similarly limit potential effects in areas where new or expanding invasive plant populations are discovered and treated.

Within the six watersheds with known infestations, and where project-related sediment/turbidity effects could potentially exceed the "discountable" threshold, effects are expected to be low magnitude and short term; newly discovered infestations would be expected to yield similar levels of effects due to project design features and caps (e.g., no more than 50 total acres of annual treatment with a 6th field watershed per year). Streams listed (303(d)) for sediment within the Middle Fork John Day and Upper John Day watersheds (see Water Quality section) are not expected to incur any detectable long-term sediment additions from project activities; spatially isolated short-term sediment effects would be limited to low-magnitude turbidity increases and pool surface-fines. Additional analysis at the sub-watershed level (6th field HUC) will be completed as part of the Section 7 ESA consultation process.

Based on the preceding analysis and professional judgment, potential project effects would represent a very small percentage of the total (cumulative) from all actions combined. Natural background seasonal fluctuation along with sediment/turbidity effects from other actions (e.g., roads, timber harvest, grazing) exceeds any potential production from invasive plant treatment by orders of magnitude.

Table 19. Cumulative effects, qualitative estimates within focus watersheds for fisheries

Watershed Name	Currently Infested acres (within 100 feet of aquatic habitat)	Other current/future Federal actions capable of contributing sediment	Percent of watershed private land (approximate)	Project-related sediment based on current infestations	Long-Term Total
Big Creek	50	Road maintenance,	60%	Low quantity,	Pre-project

Watershed Name	Currently Infested acres (within 100 feet of aquatic habitat)	Other current/future Federal actions capable of contributing sediment	Percent of watershed private land (approximate)	Project-related sediment based on current infestations	Long-Term Total
(Middle Fork John Day River)		grazing, dispersed camping		short duration (<2 years)	levels
Camp Creek (Middle Fork John Day River)	100	Road maintenance, prescription fire, timber harvest, road closures/decommissioning, culvert replacements, large woody debris in-stream placement, grazing, campgrounds, dispersed camping	<5%	Low quantity, short duration (<2 years)	Pre-project levels
Middle South Fork John Day River	28	Road maintenance, juniper and mixed conifer cutting, fuel treatment, aspen restoration, watershed improvement activities, grazing, dispersed camping, Murder's Creek Wild Horse Territory	75%	Low quantity, short duration (<2 years)	Pre-project levels
North Basin	16	Road maintenance, snow park relocation, prescription fire, timber harvest, road closures/decommissioning, hazard trees, grazing, campgrounds, dispersed camping	75%	Very low quantity, short duration (<2 years)	Pre-project levels
Pine Creek (Malheur River)	31	Road maintenance, prescription fire, grazing, dispersed camping,	60%	Low quantity, short duration (<2 years)	Pre-project levels
Upper Middle Fork John Day River	94	Road maintenance, snow park, prescription fire, timber harvest, road closures/decommissioning, aspen restoration, aquatic restoration, culvert replacements, grazing, dispersed camping	<5%	Low quantity, short duration (<2 years)	Pre-project levels

Table 20 : Watersheds containing planned future activities and invasive plant treatments

Watershed	Future Activity[1]	Current Invasive Plant Acreage[2]
Birch Creek	P	1
Bosenberg Creek	G	4
Bridge Creek	T, R,G	26
Crane Creek	T,B,	12

Watershed	Future Activity[1]	Current Invasive Plant Acreage[2]
Deardorff Creek	T	11
Dry Cr. John Day River	P	<1
Elk Creek	T,B	24
Emigrant Creek	T,R	44
Granite Boulder Creek	R,P	120
Long Creek	P	1
Indian Creek	P	1
Lake Creek	G	3
Lick Creek	G	8
Little Boulder Creek	T,B,R	139
Long Creek	P	18
Lower Bear Creek	T,B	1
Lower Deer Creek	T,	1
Lower Scotty Creek	T,B	3
Middle Bear Creek	T,B	2
Middle Silvies River	R	6
Mill Creek	R	145
North Basin	T,B,F,R	15
Pine Creek	B,R,	79
Slide Creek	P	6
Starr Creek	T,F,B	16
Summit Creek	T,B,G	15
Upper Big Creek	G	5
Upper Camp Creek	G	14
Upper Deer Creek	P	1
Upper Fox Creek	P	22
Upper Long Creek	P	18
Upper Malheur River	P	45
Upper South Fork John Day River	T	46
Upper Silver Creek	T,B,R	20
Upper Silvies River	T,B,F,R,P	56
Van Aspen-Silvies River	T,B	15
Vinegar Creek	T,B,R	81
Wiley Creek	P,B,R	2
Wolf Creek	T	38
Total Acreage Invasive Plants		**1,067**

1 – Activity Codes (T)-Timber harvest, (B)-Burning, (F)-Fuel Reduction, (R)-Recreation/facility, (P)-Plantation thinning, (G)-Grazing improvements. 2 – Invasive plants that don't occur in watersheds with foreseeable future projects are not displayed.

Several other stressors on fish exist, including hydropower development, habitat degradation from human activities, direct harvest of fish, and competition from hatchery fish (USDA 2008b). These are part of the existing condition for aquatic organisms and this project will not influence these conditions.

The analysis assumes maximum levels of treatment over the life of the project. Even given these unlikely treatment levels, project-related additions to existing cumulative effects are likely to be minor or non-existent. At any given site, direct or indirect adverse effects to aquatic organisms under all alternatives would be low magnitude, localized, and short term. The potential to affect the aquatic environment is limited to a low amount of herbicide or sediment, and minor impacts on native riparian vegetation. These effects are not of a type or extent that would combine with ongoing human activities or foreseeable projects on the Forest and produce long-term, cumulative impacts, even considering the vectors of invasive plant spread described in chapter 3.1.5 (project EIS).

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Direction from R6 FEIS ROD, combined with project design features and caps, would be implemented to maintain consistency with the Regulatory Framework cited above. INFISH/PACFISH each have provisions for applying herbicides in riparian areas so that attainment Riparian Management Objectives are not compromised. In addition, the Malheur National Forest LRMP documents require enhancement or maintenance of characteristics of riparian areas to meet wildlife and fisheries habitat needs.

PACFISH-INFISH Compliance

Treatment of invasive plants would comply with PACFISH/INFISH, specifically standard RA-3. As discussed previously, invasive plant treatments would not adversely affect, retard or prevent attainment of Riparian Management Objectives (RMOs). The only RMO that could potentially be adversely affected by project activities is bank stability. Very minor short-term effects on bank stability from erosion are possible from removal of invasive plants. However, this would not cause any stream currently above 80 percent stable (thus meeting the RMO desired condition) to drop below this value because treatments would occur on a small fraction of riparian habitat would be treated within a 6th field watershed. Effects on various species of fish were discussed previously. Adverse effects have been avoided to the extent practicable through PDFs, herbicide use buffers, and project caps. Effects to fish and habitat would be short-term and treatment of invasive plants would complement fish habitat restoration efforts over the long term.

Summary of Effects

Chemical contamination from herbicide application was assessed through use of the GLEAMS model. For all herbicides, and in all areas with known infestations, concentrations in water bodies would be expected to remain well below levels capable of directly affecting aquatic organisms; potential indirect biological effects such as effects to aquatic plants, would be spatially isolated and short-term, and unlikely to produce a measurable/observable effect to aquatic species of concern. Other indirect effects from herbicide application are possible, primarily in the time period between application and native plant regrowth when soil may be bare and slightly de-stabilized. De-stabilization of near-stream soil is more likely from non-herbicide treatment methods, such as pulling or grubbing with tools. Because a currently unknown combination of methods would likely be used at many sites, a degree of uncertainty is present. In addition, newly discovered infestation of sites could also be treated. Project design features and “caps” would be implemented to reduce realized effects related to these uncertainties. The determination statements consider these uncertainties.

The preceding analysis focused on fishes. The watershed-based results were extrapolated to invertebrates through the assumption that these sympatric species share most habitat requirements with native fishes and results are logically transferable.

Assuming that near-stream native vegetation is beneficial to aquatic habitat, the long-term result of this project for all aquatic species should be positive as invasive plants are displaced by native species. This change would presumably occur within a few years post-treatment in most cases.

Based on quantity of proposed treatment near streams, detectable effects were determined to be possible in six currently infested watersheds (5^{th} field HUC): Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River. As stated previously, project design features and caps are expected to keep effects within newly discovered and treated infestations to similar levels.

Federally Listed Fishes and their Designated Critical Habitat

For federally listed species (steelhead, bull trout) and essential fish habitat (Chinook salmon), the potential for adverse effects (based on current infestations) was determined to exist in four watersheds within the project area: Big Creek, Camp Creek, Middle South Fork John Day River, and Upper Middle Fork John Day River. Although effects (sediment/turbidity) from these activities are expected to be minor, they could exceed the "discountable" threshold, and are therefore likely to adversely affect fish and their habitat. Consultation will be completed with U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the selected alternative (Proposed Action) prior to a final agency decision. Although the discountable threshold for adverse effects under ESA may be exceeded, effects would be non-lethal and limited to fish within discrete areas. These effects would not be discernable or meaningful at the 6^{th} field sub-watershed scale.

Forest Service Sensitive Species

Forest Service Sensitive species (trout and mussel) exhibit largely overlapping ranges and similar vulnerability to effects with the federally listed fishes; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area."

Forest Service Management Indicator Species

Forest Service Management Indicator Species (MIS) (resident trout group – e.g., redband) overlap the distribution of federally listed fishes, and exhibit similar vulnerability to effects. In summary, there would be no reduction in quantity (miles) of stream habitat due to project actions. Habitat quality may be slightly reduced in the short-term due to post-implementation sediment input resulting from dead near-stream vegetation. This potential effect would occur within a fraction of 1 percent of available habitat; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area." In the long term, near-stream conditions would be improved as native vegetation re-establishes.

Based on the preceding analysis and professional judgment, potential project effects would represent a very small percentage of the total (cumulative) from all actions combined. For example: Within most watersheds, sediment/turbidity effects from roads likely exceed (e.g., by an order of magnitude or more) any potential production from invasive plant treatment. Herbicide concentrations from the project are expected to be undetectable or very low in all waterways, and would therefore add little or nothing to cumulative effects.

Based on current quantity of known infestations near aquatic habitat, the uncertainties regarding treatment type and potential newly discovered sites, and consideration of the combined impact from the project and all other foreseeable actions, the following determinations apply:

Table 21: Alternative B determinations

Species	Status	Determination
Middle Columbia River steelhead DPS and designated critical habitat	Federally threatened	May affect, likely to adversely affect.
Columbia River and Malheur River bull trout SMUs and designated critical habitat	Federally threatened	May affect, likely to adversely affect.
Middle Columbia River Chinook salmon	Essential fish habitat and USFS sensitive	Adverse modification of essential fish habitat. May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Redband trout Westslope cutthroat trout Western ridged mussel	USFS sensitive	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Resident trout group (same effects as above for same/other trout species)	USFS Management Indicator Species (MIS)	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
PACFISH/INFISH	Fish and Habitat at 6th field watershed scale	Project would not prevent or retard RMO indicators associated with PACFISH/INFISH. Adverse effects are avoided to the extent practicable given the PDFs, herbicide use buffers, and project caps.

Alternative C – Strict Limitations on Herbicide Use

Alternative C would have no spraying within 100 feet of a stream channel. The number of treatment areas acres that are within 100 feet of a stream is 462, and therefore these acres could all be mechanically or manually treated. Under alternative C, all of the alternative components for alternative B would be followed, with the following additions and changes:

- No broadcasting of herbicide would be allowed. No boom spraying would be allowed. Maximum herbicide application rates per acre would be reduced by about 30 percent across the board. PDFs related to broadcast spraying would become non-applicable.

- No herbicide use would be allowed within the 462 acres identified within 100 feet of creeks, lakes, ponds and wetlands. Non-herbicide methods would continue to be used within 100 feet of these areas. Non-herbicide methods would also continue to be used within 200 feet of well source areas. No herbicides would be used in these areas. The buffer tables would become non-applicable since no herbicide use would be allowed within 100 feet of streams.

- No more than 1,654 acres would be treated using herbicide during any year of project implementation (total infested acre minus lands within 100 feet of water bodies).

- Picloram would be eliminated from the list of available herbicides, due to its persistence, mobility and toxicity. Compared to alternative B, there would be relatively more use of herbicides such as aminopyralid, clopyralid and glyphosate in lieu of picloram.

- Herbicide would not be used on more than 24,810 total acres over the life of the project.

- Would not treat more than 30,000 acres with any method through the life of the project.

These restrictions would apply to known sites as they change over time, as well as new detections. The implementation planning process would be similar to alternative B, however the range of treatments that would be allowed would be more restrictive.

The conclusions from the analysis for alternative B generally apply to alternative C, with the following qualitative differences and clarifications.

- The risk of chemical contamination of aquatic habitat from herbicide application associated with alternative B would be eliminated due to the absence of near-stream herbicide application. See GLEAMS model results for alternative C in chapter 3.5.3 indicating the absence of any herbicide reaching streams due to the prohibition on any herbicide use within 100 feet of streams.

- A measurable increase in sediment production could result from alternative C as compared to alternative B due to an increase in non-herbicide methods, many of which would produce more soil disturbance and associated mobilization into stream channels (see chapter 3.4). Treatments would be less effective and would require more treatment entries to reach desired conditions (project EIS chapter 3.1.4) which could compound the potential effect on sediment and turbidity.

- To the extent that the greater costs and time to reach desired conditions associated with alternative C (project EIS chapter 3.1.4), there could be less short- and long-term benefit to the aquatic environment.

Direct and Indirect Effects

The conclusions from the analysis for Alternative B generally apply to Alternative C, with the following qualitative differences and clarifications.

- The risk of chemical contamination of aquatic habitat from herbicide application would logically be reduced due to the absence of near-stream application; however, the GLEAMS model produced zero or very low values for all herbicides under alternative B. It is unlikely that there would be a detectable difference in actual effects to aquatic organisms and their habitat related to herbicide application between these two alternatives.

- There could be a measurable increase in sediment production from alternative C as compared to alternative B due to an increase in non-herbicide methods, many of which would produce more soil disturbance and associated mobilization into stream channels. This would be partially offset by the lower number of treated acres, but would still likely represent an overall increase. Since such a small percentage of each watershed would be treated annually under each alternative, it is unlikely that a measurable difference would actually be measurable within aquatic habitat in most areas when assessed at the watershed or sub-watershed scale. If a segment of stream was treated to maximum specification using soil-disturbing methods, a measurable difference could occur in that particular reach but would likely be undetectable and reasonable analysis scales.

Cumulative Effects

Functionally identical to alternative B.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Same as for alternative B.

Summary of Effects

Determinations would remain the same as for Alternative B; however, sediment delivery would likely be slightly higher due to an increase in soil disturbance from mechanical/manual treatment methods. Potential herbicide input (and concentrations) into water could be slightly lower due to the lack of treatment within 100 feet of streams, but the actual difference in effects to aquatic organisms would likely be minimal or absent due to the very low concentrations expected under Alternative B in most locations.

Alternative D – No Forest Plan Amendment, No Aminopyralid

Alternative D would be identical in effect to alternative B, except a Forest Plan amendment would not be completed and aminopyralid would not be approved for use on the Forest. Aminopyralid would not be used to treat known sites or new detections. Compared to alternative B, more picloram, clopyralid, and glyphosate would likely be used in lieu of aminopyralid. Herbicide treatment could be up to 2,124 acres per year under this alternative.

Direct and Indirect Effects

The conclusions from the analysis for Alternative B generally apply to Alternative C, with the following qualitative differences and clarifications.

- The risk of chemical contamination of aquatic habitat from herbicide application would logically decrease since aminopyralid is believed to be less toxic than most of the other proposed herbicides. However, the GLEAMS model produced zero or very low values for all herbicides under Alternative B. It is unlikely that there would be a detectable difference in actual effects to aquatic organisms and their habitat related to non-use of aminopyralid, except in the case of an unexpected over-application (e.g., spill near water).

- All other potential effects would be functionally identical, including sediment.

Cumulative Effects

Functionally identical to Alternative B.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Same as for Alternative B.

Summary of Effects

Functionally identical to Alternative B, and determinations would remain the same.

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Appendices

Appendix A – Project Design Features

PDF Reference	Design Features	Purpose of PDF	Source of PDF
B – Coordination with Other Landowners/Agencies			
B1	Coordinate treatments on neighboring lands and within municipal watersheds. For neighboring lands, base distances on invasive species reproductive characteristics, and current use.	To ensure that neighbors are fully informed about nearby herbicide use and to increase the effectiveness of treatments on multiple ownerships.	A variable distance based on site and species specific characteristics was chosen because it adjusts for various conditions that exist in these areas. All pdfs related to riparian areas and buffer distances will be followed.
C – To Prevent the Spread of Invasive Plants During Treatment Activities			
C1	Ensure vehicles and equipment (including personal protective clothing) does not transport invasive plant materials.	To prevent the spread of invasive plants during treatment activities	Common measure.
D – Wilderness Areas [3]			
D1	No solarization, mechanical or motorized treatments will occur in wilderness areas. Herbicide use would be approved by the Regional Forester via a pesticide use proposal.	To maintain wilderness values, e.g., solitude, unimpeded natural processes—and comply with environmental laws and policies.	Wilderness Act, 1990 Malheur National LRMP
E – Non-herbicide Treatment Methods			
E1	Treatments implemented below the ordinary high water mark will be applied from the bank and workers will not walk in flowing streams regardless of treatment method.	To reduce the likelihood of causing negative impacts to fish and fish habitat.	Memorandum of Understanding between WDFW and USDA Forest Service, January 2005.
E2	Fueling of gas-powered equipment with tanks larger than 5 gallons would generally not occur within 150 feet of surface waters. Fueling of gas-powered machines with tanks smaller than 5 gallons may occur up to 25 feet of surface waters.	To protect riparian and aquatic habitats.	Common Measure
F – Herbicide Applications			
F1	Alkylphenol ethoxylate-based non-ionic (NPE) and ethoxylated fatty amine (POEA) surfactants would not be used. Vegetable oils/silicone blends that contain alkylphenol ethoxylate ingredients may be used.	To reduce risks associated with surfactants	SERA and Bakke risk assessments
F2	The least amount of a given herbicide would be applied as necessary to meet control objectives. In no case will imazapyr use exceed 0.70 lbs. a.i./ac. Broadcast application of Clopyralid, Glyphosate, Picloram, Sethoxydim, or	To minimize herbicide exposures of concern to human health.	SERA and Bakke risk assessments

[3] Invasive plant eradication within Wilderness meets the "no impact" intent of the Wilderness Act and associated land use policies.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	Sulfometuron methyl will not exceed typical rates across any acre. Spot spray of triclopyr would not exceed typical rates across any acre.		
F3	Broadcast herbicide applications would occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. During application, weather conditions would be monitored periodically by trained personnel.	To ensure proper application of herbicide and reduce drift.	These restrictions are typical so that herbicide use is avoided during inversions or windy conditions.
F4	To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles that minimize fine droplet spray, e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns.	To ensure proper application of herbicide and reduce drift.	These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see chapter 3 for details).
F5	No use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl and metsulfuron methyl) on dust-laden bare soils. Avoid bare areas >100 sq. ft. with powdery, ashy dry soil, or light sandy soil.	To avoid potential for herbicide drift.	Label advisory
F6	When herbicides are applied, a non-toxic blue dye will be used to mark treated areas.	To ensure treated areas are obvious to people and prevent accidental ingestion by plant collectors.	Common measure
G Herbicide Transportation and Handling Safety/Spill Prevention and Containment ▪ An *Herbicide Transportation and Handling Safety/Spill Response Plan* would be the responsibility of the herbicide applicator. At a minimum the plan would: ▪ Address spill prevention and containment. ▪ Estimate and limit the daily quantity of herbicides to be transported to treatment sites. ▪ Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ▪ Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). ▪ Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ▪ Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ▪ Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. ▪ Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the		To reduce likelihood of spills and contain any spills.	FSH 2109.14

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	extent possible. ▪ Specify conditions under which guide vehicles would be required. ▪ Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters. ▪ Require that spray tanks be mixed or washed further than 150 feet of surface water. ▪ Ensure safe disposal of herbicide containers. ▪ Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.		
H - Soils, Water and Aquatic Ecosystems			
H1	Follow herbicide-use buffers shown below. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.	To reduce likelihood that herbicides would enter surface waters in concentrations of concern and ensure that the project does not hamper attainment of riparian management objectives.	Herbicide-use buffers are based on label advisories; SERA risk assessments and Berg's 2004 study of broadcast drift and run off to streams. Herbicide-use buffers are intended to demonstrate compliance with R6 2005 ROD Standards 19 and 20.
H2	In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites, or for broadcast spraying will not travel off roadways, trails and parking areas if damage to riparian vegetation, soil and water quality, and aquatic habitat is likely.	To protect riparian and aquatic habitats.	Common protection measure
H3	Avoid using picloram and/or metsulfuron methyl on bare or compact soils, and inherently poor productivity soils that are highly disturbed. Poor soils include shallow soils less than 20 inch depth that lack topsoil and serpentine soils.	To preserve site recovery after disturbance, lessen offsite runoff and leaching. Poor soils will have longer residence times with these persistent herbicides.	Label advisory
H4	Do not use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application. Aminopyralid would not be broadcast in any are more than once per year.	Reduce potential for accumulation in soil.	SERA Risk Assessments. Based on quantitative estimate of risk from a maximum level of exposure.
H5	Limit herbicide offsite transport on sites with high runoff potential including sites with: shallow seasonal water tables, saturated soils (wet muck and peat soils), steep erosive slopes with shallow soils and rock outcrop, or bare compacted and disturbed soils. Limit runoff by applying herbicide during the dry season with the lowest soil moisture conditions, where > 50% groundcover exists on shallow slope sites, and > 70% on steep	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	slope sites, and/or at reduced rates.		
H6	For soils with seasonally high water tables, do not use picloram or triclopyr BEE and limit glyphosate use to aquatic label only.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label advisory
H7	Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.	To reduce exposure to herbicides by providing some untreated areas for organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty regarding effects to reptiles and amphibians.
H8	Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty in effects to some organisms, and label advisories.
H9	Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.	To reduce the potential for herbicide delivery to wells and springs that provide drinking water, and to protect watering systems used for grazing animals.	Label advisories and state drinking water regulations http://www.deq.state.or.us/wq/WhpGuide/ch2.htm.
H10	Use of Triclopyr BEE is only allowed in dry upland areas that are not hydrologically connected to water bodies.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label and quantitative assessment for risk to aquatic organisms.
H11	Do not spray when local weather forecast calls for a ≥ 50% chance of rain, or when wind speed at the site is in excess of 8 mph.	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.
I - Vascular and Non-Vascular Plant and Fungi Species of Concern			
I1	A USDA Forest Service botanist would use monitoring results/adaptive management to refine herbicide-use buffers in order to adequately protect botanical species on the Regional Forester's Sensitive List.	To prevent any repeated effects to sensitive botanical populations, thereby mitigating any long-term effects. Uncertainty about effects on nonvascular plants would be addressed through monitoring.	Herbicide-use buffer sizes for broadcast of most herbicides are based on Marrs 1989 based on tests on vascular plants. Spot and hand/select buffer distances are based on reports from experienced applicators.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
I2	Botanical surveys will be conducted to document locations of sensitive plants if suitable habitat is within 100 feet of planned herbicide treatments	To ensure sensitive botanical species are protected and botanical surveys are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
I3	Sensitive plants located within 100 feet of planned ground-based broadcast applications would be covered by protective barrier, or broadcast application would be avoided in these areas (spot or hand herbicide treatment, or non-herbicide methods may be used without covering sensitive plants)	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I4	When sensitive plants are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods of herbicide application (wiping, stem injection,) would be used.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I6	Monitoring prework review would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate project design features.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I7	Implementation monitoring would occur during implementation to ensure project design features are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I8	Effectiveness monitoring would occur during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially sensitive species are adequately protected.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I9	The impacts of herbicide use on some sensitive botanical species are uncertain, especially non-vascular species. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to sensitive botanical species would be monitored. Non-target vegetation within 100 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Herbicide-use buffers would be expanded if damage is found as indicated by: •Decrease in the population of the species of conservation concern •Leaf discoloration or chlorophyll change •Mortality	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	Monitoring would continue until three post-treatment visits (at one or more sites near each sensitive botanical species) confirm a lack of adverse effects.		
J - Wildlife Species of Local Interest			
J1	**Gray Wolf**		
J1-a	Treatments within 1 mile of active wolf dens or rendezvous sites would only occur outside the season of occupancy (April 1 through June 30).	Reduce impacts to active dens or rendezvous sites	Federal Register (USDI FWS 2003)
J2	**Bald eagle**		
J2-a	Noise-producing activity above ambient levels would not occur near known winter roosts and concentrated foraging areas between October 31 and March 31 during the early morning or late afternoon. Disturbance to daytime winter foraging areas would be avoided.	Minimize disturbance and energy demands during the winter.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981); USDI FWS 2007, No, 62 4(d)
J2-b	Treatment of areas within 0.25 mile, or 0.50 mile line-of-sight, of bald eagle nests would be timed to occur outside the nesting/fledging season of January 1 to August 31, unless treatment activity is within ambient levels of noise and human presence (as determined by a local specialist). Occupancy of nest sites (i.e. whether it is active or not) would be determined each year prior to treatments.	Reduce impacts to eagle nests and reproduction.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981) and, USDA Forest Service 2005a
J3	**Peregrine Falcon**		
J3-a	Seasonal restrictions shall apply to all known peregrine falcon nest sites for the periods and elevations listed below: a. Low elevation sites (1000-2000 ft.) – Jan 1st to July 1st b. Medium elevation sites (2001-4000 ft.) – Jan 15th to July 31st c. Upper elevation sites (greater than 4000 ft.) – Feb 1st to Aug 15th These restrictions may be waived if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior. Seasonal restrictions shall be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging will occur. Protection would be provided until at least two weeks after all young have fledged.	Reduce disturbance to nesting birds and protect eggs and nestlings.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-b	All invasive plant treatments would be restricted within 0.5 miles of peregrine falcon nests (primary nest zone) during the nesting season (described above).	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J3-c	Invasive plant treatments involving motorized equipment and/or vehicles would be seasonally prohibited within the secondary nest zone (0.5 miles to 1.5 miles of known nest sites) during the nesting season. This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically-based invasive plant treatment.	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-d	Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) may occur within the secondary nest zone (0.5 miles to 1.5 miles of known nests) during the nesting season, but would be coordinated with the wildlife biologist on a case-by-case basis to determine potential disturbance to nesting falcons and identify mitigating measures, if necessary.	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-e	Picloram and Clopyralid would not be used within 1.5 miles of a peregrine nest more than once per year.	Reduce herbicide exposure to eggs.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J4	**Greater Sage Grouse**		
J4-a	Glyphosate use would be limited to the typical application rate.	Minimize exposure to herbicides and surfactants that could pose a risk.	Biological Evaluation for Malheur Invasive Plant EIS, USDA Forest Service 2000.
J4-b	Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15 – May 15.	Minimize disturbance to breeding grouse	Connelly et al. 2000, USDI FWS 2003.
J4-c	Do not conduct any vegetation treatments or improvement projects in breeding habitats from February 15 – June 30.	Minimize disturbance to breeding grouse	Connelly et al 2000
J5	**Columbia Spotted Frog**		
J5-a	Avoid broadcast spraying of herbicides, or spot spraying of sulfometuron methyl within 100 feet of occupied or suitable spotted frog habitat. Follow herbicide-use buffers in wetlands. Treatment methods, timing and location will be coordinated with a local biologist prior to implementation.	Reduce impacts to the Columbia spotted frog.	Appendix P of the R6 2005 FEIS; SERA 2003, 2004; Bakke 2003
J6	**Silver bordered fritillary**		
J6-a	Within occupied sites, follow pdfs identified under vascular plants of concern to protect host/nectar plant species.	Reduce the likelihood host/nectar plants would be affected.	Malheur Invasive Plant BE.
J6-b	Within occupied habitat proposed for treatment, use of ester formulations of herbicide would be prohibited.	Minimize exposure of herbicides and surfactants that could pose a risk to the silver bordered fritillary.	Malheur Invasive Plant BE.
J7	**Pygmy Rabbit**		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J7-a	Within suspected burrow areas, activities will be restricted to manual techniques. Treatment methods, timing and location will be coordinated with a local biologist.	Minimize chances a burrow would collapse.	Malheur Invasive Plant BE.
J8	**Upland Sandpiper**		
J8-a	In order to avoid disturbance or potential trampling of nesting upland sandpipers, no treatment would occur on sites that have historic or recent documentation of upland sandpipers during the nesting season (April 1st to August 1st), unless the site has been surveyed and no nesting is occurring.	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant BE.
J9	**Grasshopper Sparrow**		
J9-a	In order to avoid disturbance or potential trampling of nesting birds during the nesting season (May 1st to August 1st), no treatment would occur on sites where grasshopper sparrows have been documented.	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant BE.
J10	**Harney Basin Duskysnail**		
J10-a	If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers.	Minimize likelihood that snails would be harmed from treatment	Malheur Invasive Plant BE
J11	**Featured Species: Raptors and Osprey**		
J11-a	Active raptor nest sites will be protected during implementation. If a raptor nest is found within 0.50 mile of a site proposed for treatment, a wildlife biologist will be consulted to determine appropriate seasonal restriction dates and buffer distances, if necessary.	Reduce impacts to raptor nesting and reproduction.	Malheur and Ochoco LRMP
J12	**Big game**		
J12-a	Restrict off-highway vehicle use within MA 41 (big game winter range) between December 1 and April 1.	Reduce disturbance to wintering elk and deer.	Malheur LRMP
J12-b	To prevent harassment in designated calving areas, restrict off-highway vehicles and other motorized traffic use to designated roads and trails from May 1 to June 31.	Reduce impacts during elk calving.	Malheur LRMP
J-13	**Yellow-billed Cuckoo**		
J13-a	If a known breeding site is proposed for treatment a biologist will be contacted to determine protection measures. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers. Protection measures would be coordinated with the USFWS.	Minimize likelihood that nests would be affected by treatment	Professional judgment
K	**Public Notification**		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
K1	High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also L2 for special products and M1 for cultural plants.	To ensure that no inadvertent public contact with herbicide occurs.	These are common measures to reduce conflicts.
K2	The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.	To ensure applicators know what area has been treated and to ensure no inadvertent public contact with herbicide occurs.	R6 2005 ROD Standard 23 (see table 1).
L	**Special Forest Products**		
L2	Members of the public who identify specific forest product collection areas, non-target edible or medicinal species they collect, or areas of cultural or spiritual value, will be informed about upcoming use of herbicide in the area. Specific edible or medicinal plant collection areas identified by the public would be prominently posted prior to spraying.	To minimize potential for public exposure to herbicides and acknowledge the public's need to know whether herbicide may be used in specific areas where they harvest medicinal or edible plants.	R6 2005 ROD Standard 23
L4	Flyers indicating upcoming herbicide treatments and explaining the use of blue dye may be included with mushroom and special forest product collection permits, in multi-lingual formats if necessary. See section K.	To minimize potential for public exposure to herbicides	R6 2005 ROD Standard 23
M	**American Indian Tribal and Treaty Rights and Archaeology**		
M1	American Indian tribes would be notified annually as treatments are scheduled so that tribal members may provide input and/or be notified prior to gathering cultural plants. Cultural plants identified by tribes would be buffered as above for botanical species of concern; (see section I2, I3, and I4).	To ensure that no inadvertent public contact with herbicide occurs and that cultural plants are fully protected.	Government to government agreements between American Indian tribes and the Malheur National Forest.
N	**Range Resources**		
N2	Permittees will be notified of annual treatment actions at the annual permittee operating plan meeting, and/or notified within 2 weeks of planned treatments of infestations > 1 acre in size.	To ensure permittee has knowledge of activities occurring within the allotment	Common Practice
N3	Follow most current EPA herbicide label for grazing restrictions.	To ensure grazing animals are not exposed to chemicals	EPA labeling requirements

Appendix B – Current and foreseeable Forest Service Projects

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Bald Butte LO Decommission	Remove Lookout with explosives	Recreation Site management	Middle Silver Creek	2013
Bear Creek Riparian Juniper Thinning	Thin 47 acres of juniper	Vegetation Management	Upper South Fork John Day River	2014
Blue Mountain Snow Park	Clearing trees and leveling 7 acres and paving parking area; construction of warming hut, restrooms, and grooming shed; construction of pad for fuel tank	Recreation Site management	Summit Creek (170702030102)	2013
Buck and Rock Springs Campground Hazard Tree Removal Project	Remove hazard trees	Recreation Site management	Upper Silver Creek and Wolf Creek	2013
Camp Creek LWD	Felling and placing entire trees ranging from 4- 20 inches in diameter within the following streams and their associated Riparian Habitat Conservation Areas (RHCAs)	Stream Restoration	Upper Camp Creek (170702030205); Lick Creek (170702030205)	2013-14
Campground Hazard Tree Project	Remove hazard trees in D-Lake, Idlewild, Joaquin Miller, Yellowjacket, Emigrant Creek, Falls Camp	Vegetation Management	Upper Silver, Upper Silvies, North Basin, Emigrant Creek	2013
Dairy EA	Commercial harvest, road closures and decommissioning	Vegetation Management	Upper Silver Creek	2013-2014 road closures may go on for years
Damon	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Van Aspen-Silvies River (171200020105); Lower Scotty Creek (171200020104); Shirtail Creek (171200020301)	FY 11 to FY 13
Dragon's Head Plantation PCT	thin plantations	Vegetation Management - Ground disturbance, open canopy	Wolf Creek and Upper Silvies River	2013 and beyond
Dragon's Hump Plantation PCT	PCT and treat slash on 5000 acres of plantations	Vegetation Management	Middle Silvies and Emigrant Creek	2013 and beyond

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Egley Aspen Restoration Project	thin and remove conifers up to 20.9 inches in 20 acres of aspen	Vegetation Management	Emigrant Creek	2013
Egley/Pine Springs Overlook Interpretive Display Update and Toilet Replacement project	replace toilet	Recreation Site management	Middle Silver Creek	unknown, no funding, low priority
Elk 16	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Elk Creek and Crane Creek Subwatershed	FY 2015
Galena Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Vinegar Creek-MFJDR (170702030201); Little Boulder Creek-MFJDR (170702030202)	FY 14 to FY 17
Green Ant Project (Formerly the Ant and Emigrant Projects)	Commercial harvest, road closures and decommissioning	Vegetation Management	Emigrant Creek	2013 and beyond
Idlewild Snowpark Relocation Project	Relocate snowpark	Recreation Site management	North Basin	2013
Jane Hazardous Fuel Reduction Project	RX fire, commercial and non- commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Wolf Creek	2013 and beyond
JB Spring Development and Trough	Develop spring, thin 5 acres of juniper	Livestock Grazing, Vegetation Management	Griffin Creek/Upper Malheur River	2013
Keeney Meadows Aspen	Non-commercial thinning and fencing 10 aspen stands	Vegetation Management	Bridge Creek (170702030105); Headwaters Long Creek (170702030401); East Fork Beech Creek (170702010802); Upper Camp Creek (170702030205); Headwaters Long Creek (170702030401);	July - Aug 2014
Logan Valley Grazing Authorization	Grazing authorization on the Summit Prairie, Logan Valley, McCoy Creek, and Lake Creek Grazing Allotment	Livestock Grazing	Lake Creek, Bosenberg Creek, Upper Big Creek, Summit Creek Subwatershed	FY 2014

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Malheur River Range Aquatics Projects	Extension of the Malheur River Drift Fence. Cross Springs water source reconstruction and extension to a second trough. Development of Dollar Basin Spring	Livestock Grazing	Lake Creek and Bosenberg Creek Subwatershed	FY 2013
Marshall/Devine Hazardous Fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Upper Silvies River and North Basin	2013-2014 road closures may go on for years
Murderer's Creek Juniper Management Project	Cutting of juniper and mixed conifer, fuel treatment, aspen restoration, and watershed improvement activities.	Vegetation Management; Stream Restoration	Deardorff Creek (170702010502); Corner Creek-South Fork John Day River (170702010402); Lower Murderers Creek (170702010305); Lower Deer Creek (170702010206)	FY 2014
Plantation Maintenance Fox/Camp Creek	Non-commercial thinning of plantations	Vegetation Management	Dixie Meadows (170702010602); Bear Creek (17070201603); Grub Creek (170702010607); Upper Beech Creek (170702010801); East Fork Beech Creek (170702010802); Lower Beech Creek (170702010803); Birch Creek (170702010905); Dry Creek-John Day River (170702010906); Belshaw Creek (170702011003); Cummings Creek (170702011005); Wiley Creek (170702020902); McHaley Creek (170702020903); Lower Fox Creek (170702020904); Upper Cottonwood Creek (170702020905); Upper Camp Creek (170702030205); Lick Creek (170702030206); Lower Camp Creek (170702030207)	FY 13 to FY 23

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Plantation Maintenance Long Creek	Non-commercial thinning of plantations	Vegetation Management	Indian Creek-MFJDR (170702030303); Slide Creek (170702030304); Granite Creek-MFJDR (170702030305); Headwaters Long Creek (170702030401); Upper Long Creek (170702030402); Basin Creek (170702030404); Basin Creek (170702030406); Upper Deer Creek (170702021001); Upper Fox Creek (170702020901); McHaley Creek (170702020903)	FY 12 to FY 22
Sawtooth and Emigrant Creek Culvert Replacement	replace culverts	Stream restoration	Emigrant Creek	Sawtooth complete, Emigrant creek not, no funding, low priority
Sawtooth and Nicoll Checkdam Modification	modify existing structures	Stream restoration	Emigrant Creek and Upper Silver Creek	unknown, no funding, low priority
Schurtz Creek Story-Fry Riparian Restoration Project	Fence and thin conifers less than 21 inches	Vegetation Management	Wolf Creek	2013-2014
Season of Burn Research Project	Rx burn research units	Vegetation Management	Pine Creek and Upper Silvies River	2013 and beyond
SF John Day Culverts Replacements	Replace 3 culverts	Stream Restoration	Upper South Fork John Day River	2013 and beyond
Soda Bear	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Middle Bear Creek (171200020202); Lower Bear Creek (171200020204)	FY 13 to FY 15
South Fork John Day Riparian Juniper Thinning	thin 90 acres of juniper	Vegetation Management	Upper South Fork John Day River	unknown, no funding, low priority
Starr Aspen	Commercial and Non-commercial thinning, Rx fire, fencing, wood in streams, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Starr Creek-Silvies River (171200020102)	FY 15

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Starr HFRA	RX fire, commercial and non-commercial harvest, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings	Starr Creek-Silvies River (171200020102)	FY 12 to FY 15
Summit	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Summit Creek and Tureman Creek Subwatersheds	FY 2016
Thompson Butte SUP Passive Reflector Removal	remove reflector	Recreation Site management	Pine Creek	2013
UMF Culvert Replacement	Replacement of 15 culverts located on twelve tributaries in two watersheds of the Middle Fork John Day River subbasin.	Stream Restoration	Summit Creek (170702030102); Bridge Creek (170702030105); Vinegar Creek-MFJDR (170702030205); Little Boulder Creek-MFJDR (170702030202); Granite Boulder-MFJDR (170702030203); Balance Creek (170702030208)	July - Aug 2014
Upper Pine Hazardous fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Pine Creek	2014-2015 road closures may go on for years
Voigt Ditch Headgate Replacement	Replacing current head gate with a new one including a measuring device and extending pipe down existing easement.	Adjacent Agriculture	Mill Creek (170702030106)	July - Aug 2013
Whistle Prescribed Burn	Prescribed Burn 3450 acres	Ground disturbance, open canopy	Upper Silver Creek	unknown, low priority
Access and Travel Management	Designating roads available for use	Road Use	All	On Hold